Welsh's milkweed

Asclepias welshii N. H. Holmgren & P. K. Holmgren

Photo by Daniela Roth; U.S. Fish and Wildlife Service.

5-Year Review: Summary and Evaluation

U.S. Fish and Wildlife Service

Utah Field Office

Salt Lake City, Utah

November 23, 2015

5-YEAR REVIEW

Species reviewed: (Welsh's milkweed) *Asclepias welshii*

TABLE OF CONTENTS

5-YEAR REVIEW
Welsh's milkweed (*Asclepias welshii*)

1. GENERAL INFORMATION

1.1. Purpose of 5-Year Reviews

The U.S. Fish and Wildlife Service (Service) is required by section 4(c)(2) of the Endangered Species Act (Act) to conduct a status review of each listed species at least once every 5 years. The purpose of a 5-year review is to evaluate whether or not the species' status has changed since the time it was listed or since the most recent 5-year review. Based on the outcome of the 5-year review, we recommend whether the species should: 1) be removed from the list of endangered and threatened species; 2) be changed in status from endangered to threatened; 3) be changed in status from threatened to endangered; or 4) remain unchanged in its current status. Our original decision to list a species as endangered or threatened is based on the five threat factors described in section 4(a)(1) of the Act. These same five factors are considered in any subsequent reclassification or delisting decisions. In the 5-year review, we consider the five threat factors using the best available scientific and commercial data on the species, and we review 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 that includes public review and comment.

1.2. Reviewers

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1.3. Methodology used to complete the review

On June 20, 2011, we published a Notice of Review in the Federal Register (FR) (76 FR 35906) soliciting any new information on Welsh's milkweed (*Asclepias welshii*) that may affect its classification as endangered or threatened. Comments and information were received for this project from the Navajo Nation and the Utah State Office of the Bureau of Land Management. This 5-year review was primarily written by the Utah Field Office with substantive contributions and review by our Region 6 Regional Office. It summarizes and evaluates information provided in the recovery plan, current scientific research, and surveys related to the species. Pertinent literature and documents on file at the Utah Field Office were used for this review and additional literature and documents were obtained as needed and added to the file (see section 5 for a list of cited documents). We interviewed individuals familiar with Welsh's milkweed to clarify or obtain specific information.

1.4. Background

1.4.1. Federal Register Notice citation announcing initiation of this review

76 FR 35906, June 20, 2011

1.4.2. Listing history

Original Listing
Federal Register Notice: 52 FR 41435, October 28, 1987
Entity Listed: Species
Classification: Threatened range-wide

Critical Habitat: Designated in the same action (See Figure 1)

1.4.3. Review History

Since the species' listing (52 FR 41435, October 28, 1987) we have not conducted a 5-year review. However, we reviewed the species' status in the 1992 Recovery Plan (Service 1992). On June 20, 2011, we initiated this 5-year review of the Welsh's milkweed (76 FR 35906).

1.4.4. Species' Recovery Priority Number at start of 5-year review

At the start of this 5-year review, the Recovery Priority Number for Welsh's milkweed was 11C. This number indicated: 1) the plant was listed as a full species; 2) populations face a moderate degree of threat; 3) recovery potential is low (see TABLE 1); and 4) that the species is in some conflict with development or other forms of economic activity

Table 1. Welsh's milkweed (*Asclepias welshii*) recovery priority number as determined by the Service's ranking system (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

1.4.5. Recovery Plan

Name of plan: Welsh's milkweed (*Asclepias welshii*) Recovery Plan (hereafter referred to as the "Recovery Plan").

Date approved: September 30, 1992

2. REVIEW ANALYSIS

2.1. Application of the 1996 Distinct Population Segment (DPS) policy

This section of the 5-year review is not applicable to this species because the Act precludes listing Distinct Population Segments (DPSs) for plants (61 FR 4722, February 7, 1996).

2.2. Recovery Planning and Implementation[1]

2.2.1. Does the species have a final, approved Recovery Plan?

☒ Yes
☐ No

2.2.2. Adequacy of Recovery Plan?

In general, the recovery criteria are no longer reflective of the best scientific information available. The Recovery Plan is over 20 years old, and much of the information is inaccurate. Section 4(F)(1)(B)(ii) defines "objective, measurable criteria" as those that, when met, would result in a determination that the species be removed from listing under the Act. The 1992 Recovery Plan does not provide measurable recovery criteria. In order to determine whether a species is endangered or threatened, or has improved to the point of reclassification or delisting, the Act requires an explicit analysis of the 5 listing/delisting factors. The recovery objectives and criteria found in the 1992 Recovery Plan do not reference the five listing/delisting factors. Therefore, section 4.5 of this review recommends revising the recovery plan.

2.2.3. Progress toward recovery

Criterion 1: The species' known populations have been demonstrated to be at viable population levels.

Status: There are eight known populations of Welsh's milkweed: Coral Pink Sand Dunes (UT), Sand Hills (UT), State Line (UT/AZ border), Thousand Pockets (AZ), Comb Ridge (AZ), Coyote Buttes (AZ), Sand Cove (AZ), and Tuba City (AZ). Three of these populations (Coral Pink Sand Dunes, Sand Hills, and State Line) were known at the time of the 1992 Recovery Plan, and five populations (Thousand Pockets, Comb Ridge, Coyote Buttes, Sand Cove, and Tuba City) were more recently found (Figure 2). These populations are widely

[1] Recovery plans provide guidance to the Service, States, and other partners and interested parties on ways to minimize threats to listed species, and on criteria that may be used to determine when recovery goals are achieved. There are many paths to accomplishing the recovery of a species, and recovery may be achieved without fully meeting all recovery plan criteria. For example, one or more criteria may have been exceeded while other criteria may not have been accomplished. In that instance, we may determine that, over all, the threats have been minimized sufficiently, and the species is robust enough to downlist or delist the species. In other cases, new recovery approaches and/or opportunities unknown at the time the recovery plan was finalized may be more appropriate ways to achieve recovery. Likewise, new information may change the extent that criteria need to be met for recognizing recovery of the species. Overall, recovery is a dynamic process requiring adaptive management, and assessing a species' degree of recovery is likewise an adaptive process that may, or may not, fully follow the guidance provided in a recovery plan. We focus our evaluation of species status in this 5-year review on progress that has been made toward recovery since the species was listed (or since the most recent 5-year review) by eliminating or reducing the threats discussed in the five-factor analysis. In that context, progress towards fulfilling recovery criteria serves to indicate the extent to which threat factors have been reduced or eliminated.

dispersed, which suggests that although the species spreads clonally, seeds may also be dispersed long distances via wind.

We have no information to demonstrate if populations are at viable levels. Due to the clonal nature of the species and its extensive and deep root system, counts of single stems that have emerged from underground rhizomes have been used to survey Welsh's milkweed rather than counts of individual plants. It is impossible to determine from the surface which of several or many stems are connected underground as part of one individual plant, therefore it is likewise impossible with current survey methods to determine the number of individual plants within a population or a smaller grouping within that population (stand[2]), or even confirm that separate stands within a population are not part of the same organism. Thus, we have no certainty as to how many individual plants comprise a population. Initial attempts at demographic monitoring of individuals and stands were not successful due to the constantly shifting sands the plant grows in, as well as the movement of the plants themselves across the dunes. Furthermore, a population viability analysis has not been conducted. In order to determine viable population size, detailed genetic studies to discern individual plants and investigations of Welsh's milkweed's reproductive strategy are needed, in addition to demographic and population trend studies.

Available information regarding changes in stem counts at each population is presented in Section 2.3.1.2 (Table 3).

Criterion 2: Formal land management designations, which would provide long-term habitat protection for Welsh's milkweed, are established for those populations.

Status: There have been no formal land designations specifically for Welsh's milkweed. Off-highway vehicle (OHV) use is prohibited in four populations because they occur on designated Wilderness lands. In addition, Welsh's milkweed occurs in portions of the Coral Pink Sand Dunes (CPSD) that are closed to OHV use for the purposes of conserving CPSD tiger beetle. These OHV closures protect approximately 10% of the range of the species. See Recovery Action 1.11 for more detail.)

Recovery Plan Actions

In addition to the above criteria, the Recovery Plan includes recovery actions to address threats to the species and increase population viability. In this section, we

[2] For the purposes of this review, a stand is defined as a discrete grouping of stems within a population with at least three meters distance (and often much more) from any other such grouping (based on descriptions from Franklin 1993, Kneller 2002, and Robinson 2013 pers. comm.). Stems do not necessarily grow in discrete clumps. Some stems may occur very closely together while others are more widely spaced. The terms subpopulation or colony have also variably been used to describe such groupings.

briefly review our progress for each action. Figure 1 shows Critical Habitat designated at the time of listing. Table 2 summarizes the total OHV closures within the CPSD population (which is partially on BLM land and partially on CPSD State Park land).

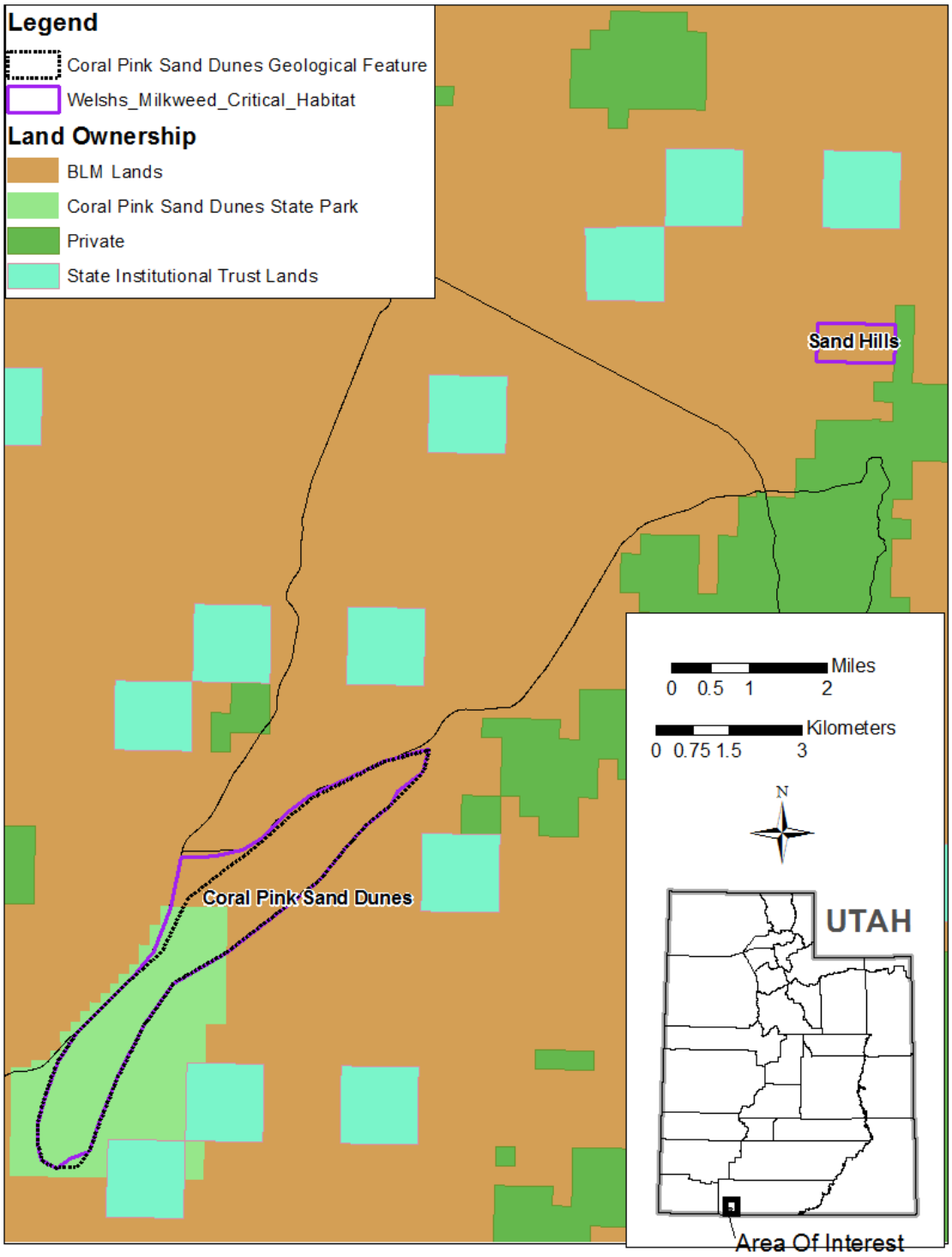

Figure 1. Welsh's Milkweed Designated Critical Habitat

Table 2. Areas of CPSD and Critical Habitat Protected from OHV use.

Total Welsh's Milkweed Critical Habitat Protected in CPSD (as of October 2015)			
	Acres Welsh's milkweed critical habitat	Acres OHV closure CPSD as of October 2015	Percent Welsh's milkweed critical habitat protected from OHV use
BLM-administered portion of CPSD	1762	571.6	32.44%
CPSD State Park	1622	330.4	20.37%
Total CPSD	3384	902.0	26.65%

(1) **Action 1.11: Establish BLM OHV closure areas in Coral Pink Sand Dunes (CPSD).**

An OHV closure area totaling 370 acres (ac) (150 hectares (ha)) was established in the BLM-administered portion of CPSD in 1998 (Bolander 2014a, pers. comm.). Eight additional closure areas, totaling 202 ac (82 ha) were added in 2013 on BLM-administered land in CPSD (Service 2014) (See Section 2.3.1.2, Figure 3). In total, OHV use is prohibited on 572 ac (231 ha) of BLM-administered land in CPSD (See Section 2.3.1.2, Figure 3 for BLM OHV closure areas in CPSD and Recovery Action 1.22 below for information on OHV closure areas in CPSD State Park). These closure areas were established to protect the CPSD tiger beetle, but also provide protection for 32% of the 1,762 ac (713 ha) of Welsh's milkweed critical habitat on BLM-administered land in CPSD (see Table 2; Service 2014). In addition, there are restrictions against driving closer than 10 feet to vegetation in the CPSD.

This recovery action is partially met and ongoing. The 1998 OHV closure area includes four BLM monitoring plots for Welsh's milkweed, and the additional closure areas established in 2013 includes one Welsh's milkweed monitoring plot but no data exists on the total number of stems or stands or the amount of occupied habitat these closures are protecting. Therefore, we do not know if sufficient locations or acreages of Welsh's milkweed habitat are protected from impacts associated with ongoing OHV use at CPSD. We also do not know whether a change in OHV traffic patterns due to the closures are impacting Welsh's milkweed stands outside of the closed areas.

(2) Action 1.12: Post BLM OHV closure areas in Coral Pink Sand Dunes.

All closed areas are clearly posted as closed. While 32% of Welsh's milkweed critical habitat on BLM-administered land in CPSD is protected from OHVs, we do not know how many stems or stands or how much occupied habitat is protected by these measures. Because shifting sand makes maintaining visibility of posting difficult, the BLM checks signage regularly and maintains postings as necessary (Conservation Committee 2014, pers. comm.).

This recovery action is partially met and ongoing; additional closure signs may be needed if additional areas need to be restricted from OHV use to protect Welsh's milkweed long term (see Action 1.11, above).

(3) Action 1.13: Enforce BLM OHV closure areas in Coral Pink Sand Dunes.

A ranger (jointly funded by the State of Utah and the BLM) patrols the BLM and CPSD State Park portions of CPSD and enforces closure areas (Church 2014, pers. comm.).

This recovery action is partially met and ongoing; additional closure signs may be needed depending on if additional areas need to be restricted from OHV use to protect Welsh's milkweed long term (see Action 1.11, above).

(4) **Action 1.14: Establish or maintain OHV closure areas in Sand Hills and Sand Cove (State Line) Populations**.

There is one OHV closure area in the Sand Hills. The 316 ac (128 ha) area designated as critical habitat in the listing rule was closed to OHV use in 2008. This area encompasses the entirety of the surveyed population at Sand Hills. OHV travel is restricted to designated routes only in the remainder of the suitable habitat in the Sand Hills, (BLM 2008; Bolander 2014, pers. comm.; Robinson 2014, pers. comm.).

The State Line population occurs within the Paria Canyon-Vermilion Cliffs Wilderness. OHV use is prohibited throughout the Wilderness Area.

This recovery action is met.

(5) Action 1.21: Develop management plan for Coral Pink Sand Dunes ecosystem

There are two formal management plans that involve the CPSD ecosystem:

- Kanab BLM Resource Management Plan (RMP) (BLM 2008)

- Coral Pink Sand Dunes State Park General Management Plan (GMP) (CPSD SP 2005)

The Kanab RMP lists management actions for Special Status Species including Welsh's milkweed. Action SSS-44 is "Close approximately 790 acres of designated critical milkweed habitat on the BLM-administered portion of the Coral Pink Sand Dunes to OHV use" (BLM 2008). To date, 572 ac (231 ha) of the 1,762 ac (713 ha), or 32%, of the BLM-administered designated critical habitat is closed to OHV use in CPSD (Service 2014). These areas were closed for the protection of the CPSD tiger beetle. While the CPSD tiger beetle and Welsh's milkweed overlap in habitat, the closure areas were designed for the tiger beetle and did not specifically consider Welsh's milkweed's distribution (Conservation Committee 2013).

The CPSD State Park General Management Plan is for the State Park portion of CPSD only. This plan does not provide any management guidance specifically for Welsh's milkweed other than identifying it as a Special Status Species that occurs in the Park (CPSD SP 2005). To date, 330 ac (134 ha) of the 1,662 ac (656 ha), or 20%, designated critical habitat in CPSD State Park is closed to OHV use (Service 2014).

Overall, 902 ac (365 ha) of the 3,384 ac (1369 ha), or 27%, designated critical habitat in CPSD is closed (Service 2014). There is no recent data for how many stands or stems or how much occupied habitat of Welsh's milkweed are protected by current closures, or whether the change in OHV use patterns impacts Welsh's milkweed stands adjacent to the closure areas.

This recovery action is partially met. The Kanab RMP management action SSS-44 is not met; an additional 218 ac (88 ha) should be closed to OHVs to meet the management action. In addition, the SSS-44 action should be reviewed for its ability to effectively protect a sufficient portion of the species' population; adaptive management should be incorporated into the Kanab RMP to allow future protections of newly discovered populations based on increased censuses (see Action 2.1, below). Currently no management plan exists covering the CPSD ecosystem as whole or addressing Welsh's milkweed specifically.

(6) Action 1.22: Establish OHV closure areas in Coral Pink Sand Dunes State Park.

One OHV closure area was established in CPSD State Park in 1998, totaling 207 ac (84 ha) under a conservation agreement for the protection of the CPSD tiger beetle, which shares some habitat with Welsh's milkweed (Bolander 2014, pers. comm.; Conservation Committee 2013).

Per the conservation agreement as amended in 2013, the existing conservation area in CPSD State Park was expanded to 265 ac (107 ha). (Service 2015). An additional six areas (totaling 65 ac or 26 ha) within CPSD State park have been closed to OHV use since that time (Table 2). (Conservation Committee 2013, Service 2015). In total, 20% of Welsh's milkweed critical habitat within CPSD State park is closed to OHV use. The new closure areas may include Welsh's milkweed but we do not know how many stems or stands or the amount of occupied habitat these closures are protecting. We also do not know whether a change in OHV traffic patterns due to the closures are impacting Welsh's milkweed stands outside of the closed areas.

This recovery action is partially met and ongoing. A complete census or survey of Welsh's milkweed within CPSD State Park is needed to determine if the tiger beetle closures provide significant protection for the Welsh's milkweed stands and stems.

(7) Action 1.23: Post OHV closure areas in Coral Pink Sand Dunes State Park.

As previously described, CPSD State Park has closed some areas to OHV use to protect the CPSD tiger beetle; Welsh's milkweed occur in some of these areas (see section 2.2.3, Progress toward Recovery, Criterion 2) (Franklin 2014, pers. comm.). As previously described, we do not know if the existing OHV closures are sufficient to protect Welsh's milkweed. Therefore, this recovery action is considered partially met and ongoing.

(8) Action 1.24: Enforce BLM OHV closure areas in Coral Pink Sand Dune State Park.

A ranger (jointly funded by the State of Utah and the BLM) patrols both the BLM and CPSD State Park portions of CPSD to enforce posted OHV closure areas (Church 2014, pers. comm.). However, as previously described, we do not know if the existing OHV closures are sufficient to protect Welsh's milkweed. Therefore, this recovery action is considered partially met and ongoing.

(9) Action 1.3: Monitor Welsh's milkweed populations.

Annual monitoring occurs at 3 out of 8 Welsh's milkweed populations (CPSD, Sand Hills, and State Line), all of which were known at the time of the 1992 Recovery plan. The CPSD population on BLM land is monitored annually through stem counts in ten study plots (eight of which were established in 1989 and two of which were established in 1996). The portion of the CPSD population in CPSD State Park is not monitored, although it was included in the 2002 census of CPSD via stem counts

(Kneller 2003). The Sand Hills population is monitored annually in two study plots (one established in 1989 and one established in 1996) (Palmer 2001). The State Line population (referred to in the Recovery Plan as Sand Cove), was censused via stem counts annually since 1989 (except for 1991, 1992, and 2002) (Hughes 2012).
The five remaining populations do not receive consistent monitoring or surveys.

The original BLM monitoring protocol for CPSD and Sand Hills was implemented in 1989 and recommended that stationary plots be monitored annually through stem counts, although we don't know the relationship between single stems and distinct individuals and are not able to be determined through current monitoring methodology.

Consistent, meaningful monitoring of this species is a challenge for several additional reasons. The stems are typically identified in the field as "primary" (young stems or seedling with linear leaves), "secondary" (stems that are larger with more rounded leaves) and "mature" (stems that are large with very rounded leaves which may or may not bear flowers or fruit). There is usually no distinction made between "primary" stems which arise from the rootstock and those from newly germinated seeds, no distinction between "mature" stems which are actively reproductive and those which simply resemble reproductive stems, and the "secondary" stem classification is somewhat nebulous and may have been applied differently by different surveyors. In some cases, stems counted as "secondary" are recorded as bearing fruit and flowers, and some surveyors count stems as "mature" only if reproductive. Some stems have both primary and secondary leaves on them, and container-grown milkweed plants were observed with "mature" stems after only one year of growth (Kneller 2003, Palmer 1999).

The use of stationary plots was found to be inadequate due to the movement of the dunes and the milkweed stands on the dunes, in many cases showing an artificial decline in stem abundance in the plots. In 2011, a new BLM monitoring protocol was implemented, which recommended using transitory plots that followed the plant stands across the dunes (RMER 2011).

This recovery action is partially met and ongoing. Monitoring programs that take into account the particular biology and habits of the species should be established for all Welsh's milkweed populations. Methodology to determine or estimate the number of individual plants in a population should be developed, as all surveys currently rely on stem counts and we do not know the relationship between number of stems and number of individual plants.

(10) Action 2.1: Identify, delineate, and census existing populations of Welsh's milkweed.

Of the three populations listed in the Recovery Plan, all were surveyed or censused via stem counts the year the Plan was finalized. At the CPSD population, only the portion of the population in CPSD State Park was surveyed prior to the recovery plan. The additional five populations discovered since 1992 are inconsistently surveyed.

This recovery action is partially met and ongoing. However, the action should be revised with details regarding the schedule and methodology for ongoing plant censuses. Consistent, detailed surveys of population size, demographics, reproductive success, and impacts to the populations (including grazing, OHV use, insect predation, competition, and drought) should be performed regularly for all populations to provide an up-to-date baseline for determining population trends and factors affecting the species. More detailed and frequent monitoring should be targeted at the populations of most concern and rely on a well-developed and scientifically useful sampling scheme. In addition, methodology to determine or estimate the number of individual plants in a population should be developed, as all surveys currently rely on stem counts and we do not know the relationship between stems and individual plants. Surveying efforts should focus first on those populations which have not recently been visited or have never been fully surveyed or delineated.

(11) Action 2.2: Identify and survey potential habitat of Welsh's milkweed.

Since 1992, surveys within suitable habitat led to the discovery of five new populations of the species. The eight known populations are widely dispersed. Wind is the presumed seed dispersal mechanism because Welsh's milkweed seeds have a pappus (a sometimes feathery or bristly modification to a flower) that is suitable for wind dispersal, and the CPSD is subject to high winds.

Large areas of un-surveyed suitable habitat remain in dune systems across southern Utah and Arizona.

This recovery action is partially met. Due to the size of the potential habitat and the difficulty of reaching many of the remote and isolated dune fields, a complete survey may never be practical. However, targeted surveys in the most likely suitable habitat should be prioritized and conducted in order to attempt to obtain a more accurate picture of distribution and numbers.

(12) Action 3: Determine the biological and ecological factors which control the distribution and vitality of Welsh's milkweed populations and the interaction of the significant biotic and abiotic elements of Welsh's milkweed and its critical habitat.

Research was performed on seed germination, as well as soil and moisture requirements (Palmer 1999; Palmer 2001), but little is known about pollination and insect predation for this species (Service 1992; Tepedino 2014, pers. comm.; RMER 2012) (see Sections 2.3.1.1 and 2.3.2.3 for more information). A genetic study of Welsh's milkweed was begun in 2008, but is incomplete (see Section 2.3.1.3 for more information). There is no planned research to study the biological and ecological factors which affect the distribution of Welsh's milkweed.

The primary abiotic factor affecting the Welsh's milkweed population is OHV use. OHV disturbance has been studied in the BLM-administered portion CPSD as part of annual monitoring efforts. This research has been done by having monitoring plots both open and closed to OHV traffic, and through reporting on visible OHV activity in the plots and damage to stems during annual monitoring. However, the results from the comparison plots are inconclusive, partially due to the inadequacy of the original stationary plot design (Esplin 2007; Palmer 1999, RMER 2012). In addition, annual monitoring of the plots does not coincide with peak OHV use (Kneller 2003), and reporting of OHV activity and damage is not standardized across annual monitoring reports (see Section 2.3.2.1 for more information).

This recovery action is partially met**.** Additional research on the genetics, demography, pollinators, breeding system (e.g., sexual and asexual reproduction, outcrossing mechanisms), seed dispersal mechanisms, and effects of OHV use is recommended.

(13) Action 4.1: Establish monitoring plots for a minimum viable population study in at least six stands of Welsh's milkweed in the Coral Pink Sand Dunes.

The BLM monitoring at CPSD was designed to meet this action. The BLM annually monitors the number of stems in 10 plots within CSPD. As previously discussed, there is currently no method to determine in a non-destructive way which stems are connected or the actual number of individual plants in a population, and thus a minimum viable population study cannot be performed using the method available (see Recovery Criterion 1, above). In addition, the classification of stems during counts is not always consistent and plants migrate out of stationary monitoring plots over time (see Recovery Action 1.3, above). More accurate monitoring methods should be developed that can address this problem

and would allow us to determine minimum viable population levels. Such methods could include monitoring Welsh's milkweed coverage or acres occupied in conjunction with genetic studies that would allow us to estimate the number of individuals (as opposed to ramets)

Due to our inability to determine the number of plants in a population, this recovery action is not met. Incorporation of genetic and demographic studies in conjunction with the BLM annual monitoring is warranted to establish a minimum viable population size for the species.

(14) Action 4.2: Establish monitoring plots for a minimum viable population study on the Sand Hills and Sand Cove (State Line) populations of Welsh's milkweed.

Two monitoring plots are established at the Sand Hills population but none are established at the State Line population. As previously described (see Action 4.1, above), we have not been able to accurately monitor population numbers or population viability due to our inability to distinguish individual plants. More accurate monitoring methods should be developed as described in the previous section.

Therefore, this recovery action is not met**.** Incorporation of a genetic and demographic study in conjunction with the BLM annual monitoring is warranted to establish a minimum viable population size for the species. Consistent stem classification and better mapping would also help us achieve accurate long-term population monitoring.

2.3. Updated Information and Current Species Status

2.3.1. Background on the Species

2.3.1.1. Biology and life history

Welsh's milkweed is a tall, herbaceous perennial in the dogbane (Apocynaceae[3]) family, with an extensive root system of deep taproots and underground horizontally spreading rhizomes[4] giving rise to above-ground stems 10-39 inches (in) (0.25-1 meters (m)) in height (Endress and Bruyns 2000; Welsh *et al.* 2008). The species was first described in 1979 from specimens collected between 1954 and 1978 from the Coral Pink Sand Dunes of Kane County, UT (Holmgren & Holmgren 1979). It was originally believed to be restricted to that dune system, but is now known as an endemic of unconsolidated, aeolian sand dunes in southern Utah and

[3] See Section 2.3.1.4.

[4] Modified subterranean stems of a plant that are usually found underground, often sending out roots and shoots from their nodes.

northern Arizona (Kneller 2003; Welsh *et al.* 2008). It is distinguished morphologically from other members of the large (approximately 140 species) genus, *Asclepias,* by the shape and size of the anther wings, the outer texture of its fruit, and its seed, which is the largest in the genus (Holmgren and Holmgren 1979; Service 1992).

Welsh's milkweed is found on dunes ranging from 4700 to 6200 feet (ft) (1500-1900 m) in elevation (Franklin 1993). Plant communities adjacent to the dunes are commonly those dominated by pinyon pine (*Pinus edulis*), Utah juniper (*Juniperus utahensis*), sagebrush (*Artemisia* spp.), and ponderosa pine (*Pinus ponderosa*) (Esplin 2006; Welsh *et al.* 2008). Species found in direct association with Welsh's milkweed include sand mulesears (*Wyethia scabra* ssp. *attenuata*), silvery sophora (*Sophora stenophylla*), giant sandreed (*Calamovilfa gigantea*), blowout grass (*Redfieldia flexuosa*), Indian ricegrass (*Achnatherum hymenoides*) and Gambel oak (*Quercus gambelii*). For more complete information on associated species, see Service 1992; RMER 2011; RMER 2012.

Welsh's milkweed grows only on active dunes and thrives in disturbed conditions with little to no competing vegetation. It is considered a pioneer species. As sand dunes stabilize and other plant species move in, Welsh's milkweed may decline or spread via rhizomes into unoccupied, more active dunes (Palmer 2001). Rhizomes move quickly through newly deposited sand to send stems to the surface, and the stems are able withstand both high winds and the pressure of sand on slopes above them (Esplin 2006).

Welsh's milkweed stems arise singularly or in clusters from the deeply buried rootstock, with leathery leaves borne in opposite pairs along the stem. The unbranched stems die back each winter. Leaf morphology of stems changes over several or more growing seasons. Young stems (whether new seedlings or arising from slender branch rhizomes) have narrow linear leaves, 0.08 to 0.1 in wide by 0.8 to 2.4 in long (2-3 millimeter (mm) by 20-60 mm) (Welsh *et al.* 2008) and are referred to as primary stems. The leaves become larger and broader until, in mature flowering stems, the upper leaves are broadly ovate coming to an abrupt, sharp point at the tip, 1.2-2.4 in wide by 2.4-3.5 in long (3-6 centimeters (cm) by 6-9 cm), and borne on short petioles. The lower leaves of mature flowering stems are smaller, more tapering to the tip, and are not borne on petioles. Stems in between the primary and mature stages are commonly known as "secondary" stems (Palmer 2001; Welsh *et al.* 2008). Early in each growing season, the stems and foliage are covered with a dense, wooly-white pubescence, known as tomentum. Over the course of the season the tomentum is rubbed off by blowing sand until by late in the season the leaves and stems are nearly glabrous (smooth). The tomentum

may prevent damage to early, tender growth from the sand (Holmgren and Holmgren 1979; Cronquist *et al.* 1994).

Welsh's milkweed flowers from May to June; fruits develop and seeds disperse from July through September (Service 1992). The flower heads (inflorescences) are spherical, 2.5 in (7 cm) wide, and contain approximately 30 flowers. The individual flowers are larger than average for the genus and are white with rose-tinged centers. The flower heads are borne on short pedicels arising from the stem's upper leaf nodes, usually with multiple inflorescences per stem (Cronquist *et al.* 1994, Welsh *et al.* 2008). The fruit is a warty, pendulous follicle[5], containing many compressed seeds up to 0.8 in (2 cm) long, each with an attached tuft of feathery hair that aids dispersal (Service 1992; Welsh *et al.* 2008).

Flowers in the genus, *Asclepias* cannot self-pollinate; they require pollinators to produce fruits and seeds. Milkweed species are known to be insect pollinated, primarily by bees, wasps, and butterflies (Struven *et al.* 1994). No comprehensive study of Welsh's milkweed pollinators has been performed, but ten bee species from five families were observed visiting Welsh's milkweed flowers, as well as six species of wasp from two families, one species of butterfly, and one species of moth (Service 1992). Pollinators that carry Welsh's milkweed pollen include *Xylocopa californica arizonensis* (a carpenter bee), *Apis mellifera* (common honeybee), *Euphydryas anicia hermosa* (a butterfly), and *Euxoa aurulenta* (an owlet moth) (Tepedino 2014, Service 1992).

Reproduction can occur by asexual (rhizomatous) and sexual (seeds) means. Observations in the Coral Pink Sand Dunes show the species has a low rate of successful fruit development; thus, rhizomes are likely the primary means of dispersal for Welsh's milkweed (Service 1992; Palmer 2001). After seeds mature, they drop and are buried near the fruits from which they fall or are dispersed along the surface of the dune by wind (Palmer 2001, Esplin 2007). Wind dispersal also allows for long-distance seed dispersal (Esplin 2007), as populations of Welsh's milkweed tend to be isolated with some of the known populations more than 70 miles apart (although un-surveyed, suitable habitat may exist between those points). Welsh's milkweed seeds have a pappus (a sometimes feathery or bristly modification to a flower) that is suitable for wind dispersal and the CPSD is subject to high winds. Seed dispersal may also be facilitated by birds or other animals.

Welsh's milkweed plants produce seeds that retain their viability for at least 5 years, indicating the species likely maintains a seed bank (Palmer 1999). Seed germination studies found high germination levels (up to

[5] A dry fruit containing two or more seeds that splits opens along a suture when ripe.

80%) and that five year old seeds stored at room temperature had a significantly higher germination rate than freshly collected or frozen seeds (Palmer 1999). Seeds germinated at the highest rate (up to 80%) in conditions with an alternating temperature regime of 86°F (30°C) and 68°F (20°C).(Palmer 1999), suggesting that this species retains an active multi-year seedbank in the wild and may not rely solely on clonal reproduction.
Widespread germination in the wild appears to be triggered by multiple heavy rainfall events in a season. Adequate precipitation does not occur on a regular basis, and seed germination appears to be relatively rare. When seedlings emerge, survival of seedlings appears to be low (Palmer 2001). It is difficult to determine if this is the rule for the species or whether it is due to the effects of drought and unusual weather patterns occurring over the time studied.

Greenhouse-reared seedlings were successfully grown in outdoor containers for ten years (1990-2000) and plants produced stems of all growth stages (Palmer 1999). Germination and survival of seedlings grown under greenhouse conditions were negatively affected by low moisture conditions. However, established plants are considered drought tolerant because of their deep taproot and extensive rhizome structure (Palmer 1999).

The life history and population dynamics of Welsh's milkweed are not well understood. The deep and extensive root system, which may penetrate into the sandstone bedrock under the dunes, makes it impossible to determine visually what constitutes an individual plant. An individual plant has stems of different apparent maturity levels, and some stems have been observed with both primary and mature leaves (Palmer 1993; Kneller 2003). Groups of stems, referred to as stands or subpopulations (see section 2.2.3., Progress toward recovery, Status), could belong to a single plant (Palmer and Armstrong 2001). We also do not know the biomass, longevity, reproduction, and dormancy regime of an individual plant.

All research on the species is limited by the fact that stem counts are our only available methodology to assess population size. We do not know the number of individuals in any population, or the degree of genetic variation within and between populations. In addition, classification of individual stems as primary, secondary, or mature is not consistent and it is not known if this classification has any meaning, biologically. The shifting of the dunes and the movement of stands over seasons makes monitoring a challenge and tracking the growth of individual stems over multiple seasons nearly impossible. The lack of ability to delineate individual plants is also monitoring challenge, as a stand of stems could easily belong to only a few individuals, or even a single individual. Additional challenges to monitoring include the varying classification of

stem types and the migration of ramets or individuals out of monitoring plots (see discussion under Recovery Action 1.3).

Due to the difficulty of delineating individual plants for this species, all surveys, censuses, and monitoring were conducted by counting or estimating the number of visible stems. Therefore, we report stem counts as a representation of species abundance. Stem counts may indicate an increase in number of plants or size of existing plants. Although in some cases this may be a misleading metric of population health if non-reproductive stems are increasing while reproductive effort is decreasing as a response to stress (Kneller 2002). However, increase in the output of foliage or stems can also result as a response to a variety of stresses in plants, including drought and injury (Mooney *et al.* 2001). Therefore, while stem counts are a useful metric and our primary available tool, an increase in stem count cannot be unconditionally used as an indicator of increased health of a population without additional information (such as reproductive effort and size of stems) and knowledge regarding the life-history and demographics of this particular species.

2.3.1.2. Distribution, Abundance, and Trends

Welsh's milkweed is endemic to active sand dunes of south central Utah (Kane County), northern Arizona (Coconino County) and the Navajo Indian Reservation in Arizona. In 1992, the Recovery Plan estimated the total population to be 11,000 stems from three populations (CPSD, Sand Hills, and State Line distributed over a total of approximately 4,150 ac (1679 ha), with more than 99% of individuals occurring in the CPSD in Kane County, Utah. One year after the Recovery Plan was finalized, the total population size of Welsh's milkweed was estimated to be 15,400 stems from contemporary surveys of these three populations (Franklin 1993). However, as previously explained, the ability to accurately determine population numbers is hindered by the plant's growth form (see Section 2.2.3).

We now recognize a total of eight populations[6]. The five additional populations were found after 1992; three in Coconino County, Arizona (Coyote Buttes, Sand Cove, and Thousand Pockets) and two on the Navajo Indian Reservation, Arizona (Tuba City and Comb Ridge) (Coconino, Navajo and Apache counties) (Franklin 1993; Hazelton 2013, pers. comm.). Five of the eight populations (Sand Hills, State Line, Coyote Buttes, Sand Cove, and Thousand Pockets) occur entirely on BLM land while two (Tuba City and Comb Ridge) of the eight populations occur entirely on Navajo Nation land. The CPSD population occurs on

[6] The Coyote Buttes population was previously delineated as up to five separate populations. We now consider it a single population based upon NatureServe criteria.

Utah State Park land (CPSD State Park) and BLM land (see Table 3 and Figures 1 & 2 for population distribution).

Table 3. Populations of Welsh's milkweed including land ownership, acreage of habitat, stem counts and apparent trend.

Population	Alternative Population Names	Land Ownership	Acres (% total acres)	Current Estimated Stem Count[7] (est./cen., year)	Initial Stem Count (est./cen., year)	Year of Last Complete Census	Apparent Trend of Stem Counts[8]
Coral Pink Sand Dunes	None	BLM WSA/State Park	3,384 (42%)	71,491 (*census, 2002*)	12,500[9] (*estimate, 1992*)	2002	Increasing
Sand Hills	None	BLM WSA	316 (4%)	932 (*census, 2011*)	576 (*census, 1980*)	2011	Increasing
State Line	Pine Hollow Canyon BLM Coyote Buttes Sand Cove The Wave	BLM Wilderness Area	26 (<1%)	27 (*census, 2012*)	566 (*census, 1990*)	2012	Declining
Thousand Pockets	None	BLM Wilderness Area	59 (1%)	11 (*census, 2008*)	450 (*estimate, 1992*)	2008	Declining
Comb Ridge	Kayenta Capitan Valley	Navajo Nation	3,200 (40%)	200[10] (*partial estimate, 2011*)	Several hundred[8] (*estimate, 2001*)	Never	Unknown
Coyote Buttes	Coyote Buttes Slope North Top Rock Spring South Top Rock Spring Ridge Dune Cottonwood Cove	BLM Wilderness Area	80 (1%)	100 (*estimate, 2008*)	1301 (*census, 1992*)	1992	Declining
Sand Cove	None	BLM Wilderness Area	10 (<1%)	21 (*census, 2011*)	18 (*census, 1989*)	2011	Stable
Tuba City	Kaibito Plateau Tonalea	Navajo Nation	960 (12%)	200[10] (*partial estimate, 2011*)	200[10] (*estimate, 2002*)	Never	Unknown

[7] Based on last known census or estimate for each population
[8] Based on all available stem count data (censused and estimated) since the population was first discovered. The apparent trend is a judgment based on the incomplete data available.
[9] This estimate was for the State Park administered portion of CPSD only – no estimate was made for the BLM portion of the population.
[10] Estimates for these populations are based on a visual survey of a portion (approx. 30%) of the dune field at each site; at both sites the entire dune field was not surveyed and likely contains more stems than estimated here.

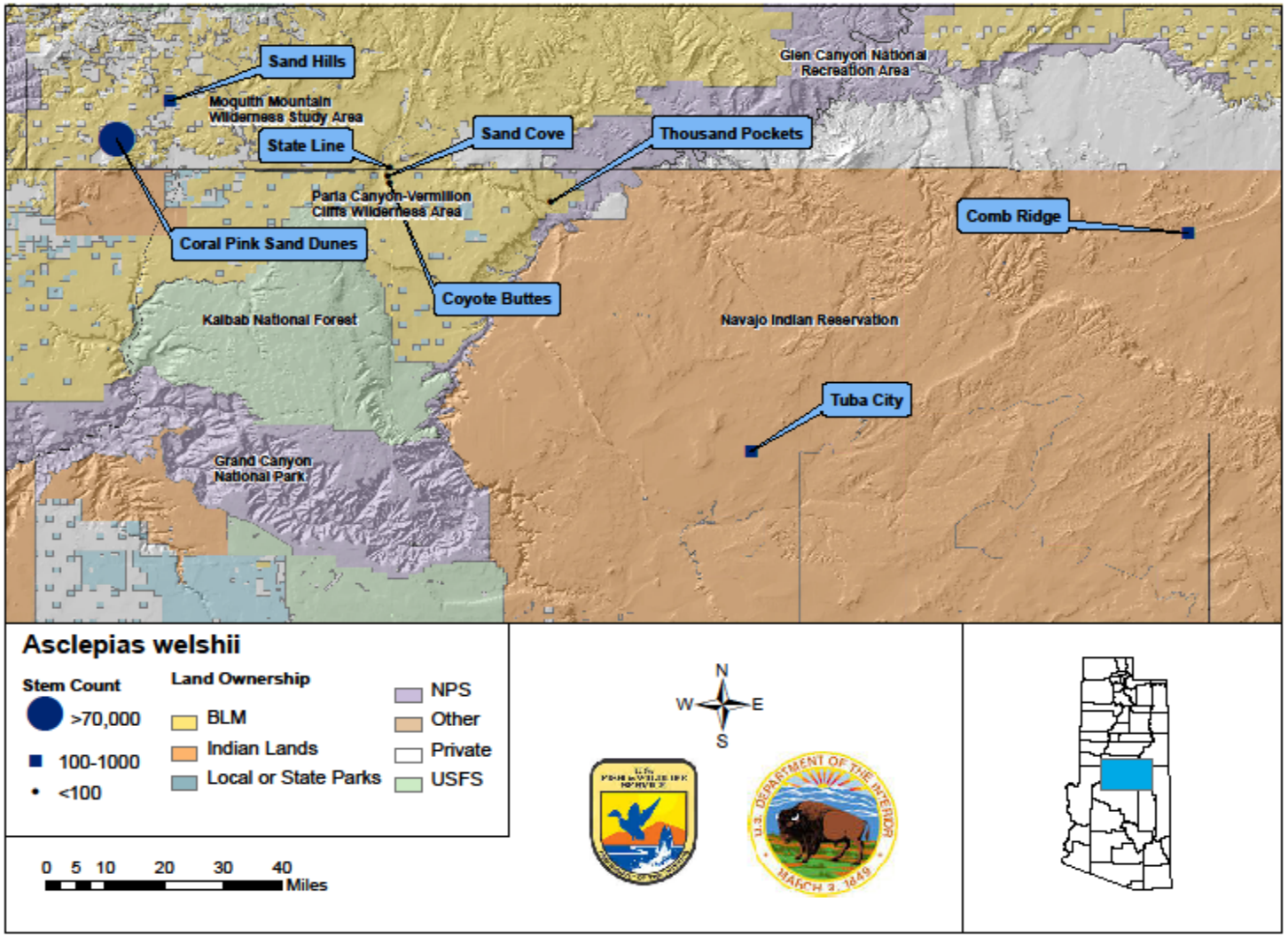

Figure 2. Known Range of Welsh's Milkweed

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An estimated 72,000 Welsh's milkweed stems are distributed over roughly 8,000 ac (3,075 ha). However, we do not have a complete census of stems for every population of the species. Some documents (including the Recovery Plan) may refer to number of individuals or number of plants, but these estimates are also based only on the number of stems. The actual total population size of genetically distinct individuals is presumed to be much less than 72,000 because there are often multiple stems for each plant.

The CPSD population was historically and continues to be the largest population (see Table 2). The CPSD population contains 98% of the known total Welsh's milkweed (Hazelton 2013, pers. comm.; Hughes 2012; Kneller 2003; Riser 2009). While five new populations were discovered since the Recovery Plan was published, their estimated population size is relatively small (although complete surveys have not been done at the two populations on Navajo Nation land). In acreage, CPSD makes up 42% of the known occupied habitat while the other seven populations make up 58%, suggesting that this population is unusual not just for the number of stems but also for its density (see Table 3).

The total stem count of Welsh's milkweed is greater today than at the time of the Recovery Plan, primarily because, as described below, the stem count of the CPSD population greatly increased from 1992 to 2002. The stem counts for the CPSD population increased from 12,500 stems in the State Park in 1992 to 31,098 in 2002. Adding in the number of stems found on BLM lands in 1992 (which were previously unknown) the total number of stems on CPSD in 2002 was 71,491.

The 1992 survey documented all the stands within CPSD State Park, and counted all the stems within each stand using binoculars (the individual stems are highly visible at a distance due to their size and the lack of other vegetation). The 2002 census individually counted and recorded all the stands and stems within the population through on-site field surveys on both State Park and BLM land. Of the 71,491 stems recorded in 2002, 40,393 stems (57%) occurred on the BLM-administered portion of CPSD and 31,098 stems (43%) occurred in CPSD State Park – an increase of more than double the 1992 number for the same area (Kneller 2003). Even accounting for potential counting errors in 1992 due to the methodology, the available data indicates a substantial increase in the number of stems between 1992 and 2002.

All but five of the approximately 400 stands from the 1992 survey were located again in 2002, and 30 new areas containing Welsh's milkweed, each consisting of multiple stands, were discovered. A total of 635 stands were found in 2002. No census of this population has since been performed, but stem abundance within 10 transitory plots was stable from 2011 to 2013 and has increased by approximately 1,000 stems since the original plots were established in 1989 and 1996 (RMER 2012; Robinson 2013, pers. comm.). In 2011, a survey in the northern portion of CPSD on BLM land found 57 new stands (consisting of approximately 3,100 stems) not recorded in the 2002 census as well as an increase in stems in previously identified stands (Robinson 2014, pers. comm.; RMER 2011). Based on this information, we conclude that the number of stems in this population is increasing.

The Sand Hills population also increased between the initial census of 580 stems in 1980 and the 2011 census of 932 stems. The monitoring plots show stable stem counts from 2011 to 2013 (Palmer 1993; RMER 2012; Robinson 2013, pers. comm.), although three years of data is not sufficient to determine long-term trend.

The Sand Cove population was censused eight times since its 1989 discovery, most recently in 2012. Stem counts were low (18 stems) in 1989 and have remained between a minimum of 12 stems and a maximum of 21 stems, but the stems were last reported to be robust with many healthy seedpods (Hughes 2012). The number of stems is stable, although the small number makes this population vulnerable to stochastic events.

The Comb Ridge and Tuba City populations have never been fully surveyed or censused, but observations of each made 9-10 years apart returned similar partial estimates of stem numbers of at least two hundred and potentially much more. The populations are distributed across large dune fields with multiple, highly spaced stands of stems (Hazelton 2013a; Roth 2013, pers. comm.). The data is inadequate to establish a trend, as no census was completed and the observations were casual and not standardized over time or area.

The number of stems in the Thousand Pockets, Coyote Buttes, and State Line populations is declining. The Thousand Pockets population decreased from an estimate of 450 stems in 1992 (Franklin 1993) to less than 20 stems as of 2008 (Riser 2009). The Coyote Buttes population decreased from 1,301 stems in 1992 (Franklin 1993) to no more than 100 as of 2008 (Riser 2009). The State Line population decreased from 566 stems in 1990 to 27 stems in 2012 (Hughes 2007; Hughes 2012). In addition, at least one of the original 5 stands in the Coyote Buttes population could not be located as of 2008 (Riser 2013, pers. comm.). We have no documented cause for the declines in stem count at these

populations, although long term drought in the area may be a major contributing factor.

Even when there is good census or survey data over multiple years for this species, we can only track changes in stem counts and cannot, using current methodology, determine how that relates to changes in the number of distinct individuals in a population. Any apparent trend determination is for stem counts only.

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

In 2008, a study was initiated to investigate the population genetics of this species by comparing genetic variation between the eight populations. Initial microsatellite analysis based on ten markers from the common milkweed (*Asclepias syriaca*) showed no genetic variation between the eight populations (Riser 2009) or between stands within those populations. The initial results suggest the absence of genetic variation between or within the populations which, if true, would indicate asexual reproduction is the primary or only means of reproduction for the species. However, it is unlikely that asexual reproduction is the sole strategy for this species, given the long distances between populations, observations of seedling recruitment in greenhouse experiments and documented seed viability for the species. It is more likely that we have not yet identified the correct genetic markers for comparison (Riser 2013, pers. comm.).

2.3.1.4. Taxonomic classification or changes in nomenclature

Asclepias welshii was first described in 1979 from specimens collected from Coral Pink Sand Dunes between 1954 and 1978 (Holmgren & Holmgren 1979). This description and classification remains the accepted taxonomic designation for Welsh's milkweed (Cronquist *et al.* 1994; Welsh *et al.* 2008). In 2003, the Angiosperm Phylogeny Group incorporated the family Asclepiadaceae to the family Apocynaceae (the dogbane family) and renamed it as a subfamily, Asclepiadoideae (APG II 2003).

2.3.2. Five-Factor Analysis - threats, conservation measures, and regulatory mechanisms

We listed Welsh's milkweed as a threatened species in 1987. The primary threats to the species cited in our Final Rule (52 FR 41435, October 28, 1987) and Recovery Plan were off-highway vehicle use and the inadequacy of regulatory mechanisms protecting the species. The species' restricted range and specific and highly restricted habitat requirements were also cited at the time as threats to its

continued existence; however, they are not now considered threats as we do not now consider endemism a threat in and of and of itself without additional evidence of a reduction in range or decrease in habitat availability. Other potential threats mentioned in our final rule were oil gas development and grazing (Service 1992).

For this 5-year review, we systematically examined what we know about Welsh's milkweed's life history in the context of the same five factors we considered when we listed the species. To better understand how a given threat affects the species, each identified threat was partitioned into **stressors**, which are processes or events that negatively impact the species. Through this threats assessment process, we evaluated each stressor for its **scope**, **immediacy**, and **intensity**, as a way to identify the true magnitude of the potential threat. We then characterized the **exposure** of Welsh's milkweed to the stressors and the **response** we would expect from the species if exposed to the stressor. Using this approach, we are able to integrate the scope, immediacy, intensity, exposure, response at the species level, and our professional interpretation, into an overall threat level (see Table 4 and APPENDIX A). The potential stressors presented in the table are ranked according to our "Draft Guidance for Conducting Threats Assessment under the Act" (Service 2006).

Table 4. Key to overall threat level ranking components.

Scope (geographic extent of the stressor)	Localized- extent sums to 1 population.
	Moderate – extent sums to more than 1 population.
	Rangewide – stressor is present throughout the range
Immediacy (timeframe of the stressor)	Imminent – is the stressor present and acting on the target now
	Future – anticipated in the future
	Historic – the impact already occurred
Intensity (the strength of the stressor itself)	Low
	Moderate
	High
Exposure (the extent to which a target resource & stressor actually overlap in space and/or time given the scope)	Small (<10% of total population exposed)
	Moderate (11-50% of total population exposed)
	High (>51% of total population exposed)
Response (level of physiological/behavioral response due to a specific stress considering growth, fecundity, and mortality rates)	Basic need inhibited–basic plant needs for growth & development
	Basic need supported-basic plant needs for growth & development
	Injury – direct physical injury
	Mortality – identifiable reduction in growth rate or survival
Overall Threat Level or Impact from Factor (integration of the scope, immediacy, intensity, exposure, and response at the species level)	Beneficial (no action is needed)
	Not a threat (this factor is a consideration in the overall species assessment but not a threat in and of itself)
	Not a threat due to adequate management (This factor would be a threat if management actions were not in place to mitigate negative effects
	Low (at this point in time, no action is needed)
	Moderate (action is needed)
	High (immediate action necessary)

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

Off Highway Vehicle Use

Off highway vehicles (OHVs) are also known as off road vehicles (ORVs) and include dune buggies and all-terrain vehicles. Five populations are protected from OHV use: Coyote Buttes, State Line, Thousand Pockets, Sand Cove and Sand Hills. OHV use is prohibited in Coyote Buttes, State Line, Thousand Pockets, and Sand Cove because they are in the Paria Canyon-Vermilion Cliffs Wilderness, while the Sand Hills population is located entirely within an OHV closure area for Welsh's milkweed designated critical habitat. The surrounding suitable habitat permits OHV use on designated trails only, and the compliance is high (BLM 2008; Church 2014 pers. comm.).

OHV use is allowed in three populations (CPSD, Comb Ridge, and Tuba City). However, no OHV use has been observed in and around the Comb Ridge and Tuba City populations likely due to the difficulty of accessing these areas. Thus, OHV use does not appear to be a concern at Comb Ridge and Tuba City.

The CPSD population is heavily used by OHVs. Under a conservation agreement for the protection of CPSD tiger beetle, the State has prohibited OHV use on 265 ac (107) in CPSD which overlaps habitat occupied by Welsh's milkweed (Conservation Committee 2014; Franklin 2014, pers. comm.). While a total of 27% of Welsh's milkweed designated critical habitat in CPSD is closed to OHV use, the majority of the dunes are open to cross country OHV use (see Figure 3).

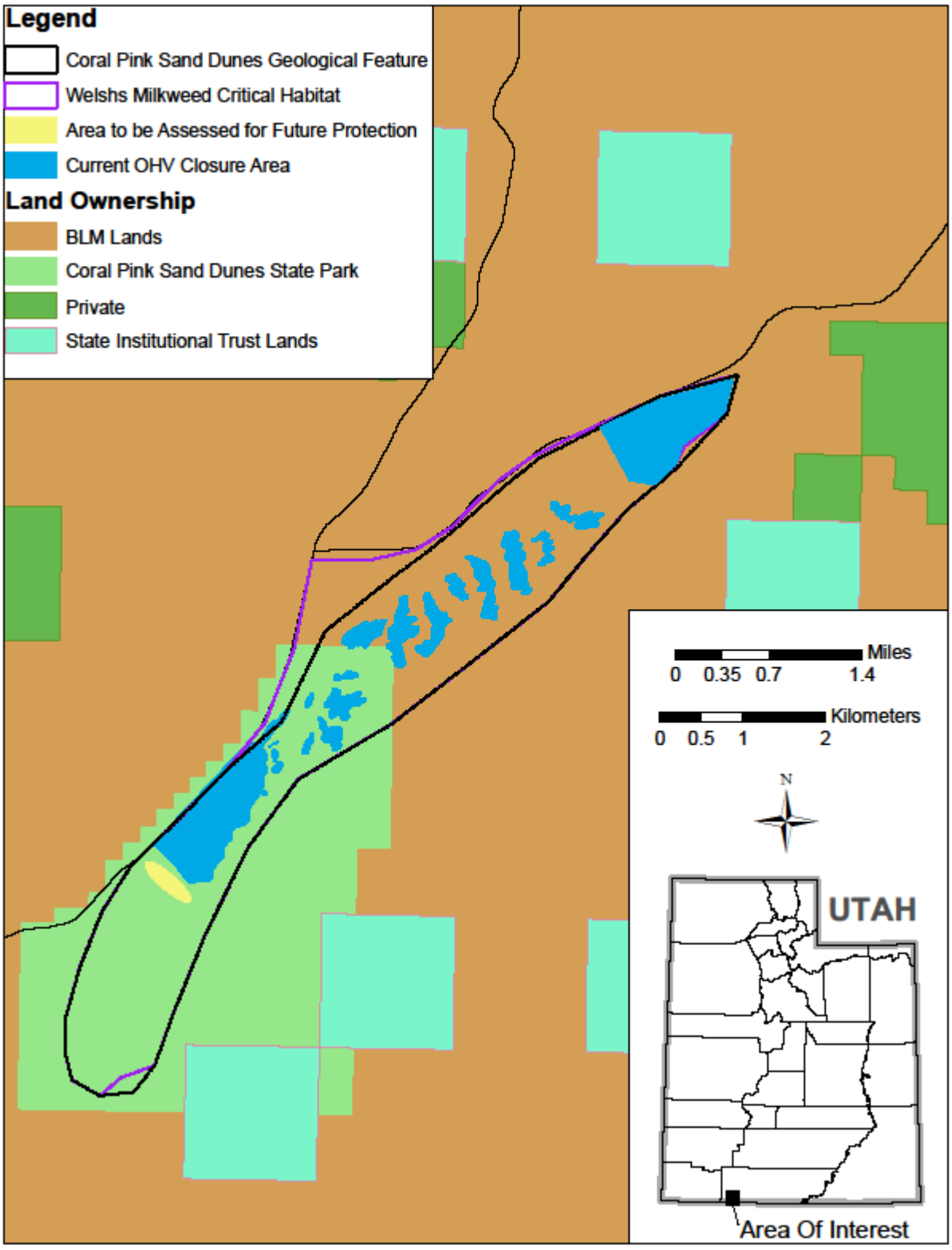

Figure 3. OHV Closures at CPSD

OHV use in the State Park portion of CPSD was estimated to be 6,227 vehicles in 2012, a significant and steady decrease from a high of 17,327 in 2007 (RMER 2012). No statistics were available for OHV use in the BLM-administered portion of CPSD but it is likely comparable. Peak OHV use in CPSD occurs in late May/early June (specifically Memorial Day weekend). This time coincides with the peak flowering period for Welsh's Milkweed. In the BLM-administered portion of CPSD, OHVs are required to stay at least 10 feet away from all vegetation and this is clearly posted and enforced (Church 2014b, pers. comm.). This provides partial protection for approximately 50% of Welsh's milkweed critical habitat in CPSD; although there is enforcement, the degree of compliance is unknown and plant damage from OHV and OHV tracks has been documented in BLM monitoring plots even during non-peak OHV season (Esplin 2006; Kneller 2002; RMER 2012). The State Park administered portion of CPSD also has signs on the two most used of the three trails which begin at the visitor's center and state that OHVs should stay 10 feet away from vegetation; however, this is this not an enforceable ordinance because no such measure is officially designated within their management documents and no data on compliance to those rules exists (Anderson 2014, pers. comm.).

The effects of OHV use on Welsh's milkweed are not fully understood and are complicated by our lack of basic biological information on the species and limited monitoring. The deep root and rhizome system of established stands or individuals likely offers some protection from OHV damage, although it is reasonable to assume that seedlings are more vulnerable than juvenile and adult plants. Repeated damage to stems in high traffic areas may result in the mortality of individual plants or plant stands within the population, but this type of data has not been documented within the monitoring plots (Kneller 2003).

The effect of OHV use on Welsh's milkweed abundance (as inferred from stem counts) is inconclusive at this time. We do not have sufficient monitoring data to determine trends in plant abundance in areas protected from OHV use as compared to areas accessible by OHV use. Based on available data, OHV use does not seem at risk of causing imminent extirpation from CPSD, however as a large, continuous factor on the primary population of the species, more information on the effect of OHV use on individual plants and the population structure is needed to determine the true impact on Welsh's milkweed.

One monitoring plot at CPSD was specifically placed in a high traffic area to monitor OHV impact, and stem counts decreased significantly since the original plot was created (from 74 stems in 1989 to 7 stems in 2013) (Palmer 2001; Robinson 2013, pers. comm.). The remaining plots open to

OHV use (five, all at CPSD) show a slightly higher rate of decreasing stem counts than in the plots closed to OHV use. The degree of OHV use in individual plots has not been recorded (see Table 4).

Table 5. Trends in stem counts and fruiting of Welsh's milkweed in monitoring plots by type of OHV use area. The amount of OHV use received by each plot in open-use areas is not known.

	Plot	Location	Year est.	Year closed	Total stem count year before closing	Total stem count 2013	Trend[11]	Number seedpods year before closing	Number seedpods 2013	Trend
Closed to OHV	BLM #2	CPSD BLM	1989	1998	94	15	D	41	0	D
	#5	CPSD BLM	1989	1998	37	43	S	12	97	I
	#6	Sand Hills	1989	2008	196	482	I	5	7	S
	#7	Sand Hills	1996	2008	82	125	I	0	53	I
	#8	CPSD BLM	1996	1998	61	171	I	2	162	I
	#9	CPSD BLM	1996	1998	227	701	I	7	3	S
	Plot	**Location**	**Year est.**	**------**	**Total stem count year est.**	**Total stem count 2013**	**Trend**	**Number seedpods year est.**	**Number seedpods 2013**	**Trend**
Open to OHV	BLM ATV	CPSD BLM	1989	------	74	7	D	0	0	S
	BLM #3	CPSD BLM	1989	------	61	88	I	10	3	D
	#1	CPSD BLM	1989	------	603	385	D	63	23	D
	#2	CPSD BLM	1989	------	805	152	D	1	27	I
	#3	CPSD BLM	1989	------	167	1,372	I	30	34	S
	#4	CPSD BLM	1989	------	70	415	I	41	95	I

[11] D = Declining, I = Increasing, S = Stable

Although this is only a small data set, stem count increased in four out of six monitoring plots in closed areas and remained stable in one of those six, while in the plots open to OHV use an equal number of plots (three out of six) showed declines and increases. No data are collected on the level of actual use each of the plots open to OHVs receives. The results from the monitoring plot placed in a high-traffic OHV area suggest that heavy OHV use may significantly decrease stem counts in those areas. A statistically valid research design is needed to compare what degree of impact the amount of actual OHV use in an area (as opposed to just being open to potential OHV use) has on total stem counts. Different areas are used by OHVs at different rates for reasons ranging from terrain and slope to the presence of existing trails. As some plots open to OHVs may receive heavier use than others, it is important to capture the level of use each plot receives along with stem counts and reproductive data in order to determine OHV impact.

OHV use has a negative effect on Welsh's milkweed reproductive effort. Based on the CPSD census in 2002, the percentage of stems in OHV closure areas with reproductive structures (flowers or fruits) was double that of stems in open OHV use areas (51% vs. 24%, respectively). Reproductive effort was higher despite increased vegetative competition and lower Welsh's milkweed stem densities in the closure areas. Primary (mostly juvenile, non-reproductive) stems accounted for approximately 5% of the population in closure areas compared to 23% of the population in OHV use areas. This result suggests that fewer stems are reaching maturity in areas subject to OHV use (Kneller 2003).

OHV use physically damages Welsh's milkweed plants by either crushing or removing portions of the plants. OHVs can damage all above ground portions of the plants including vegetative stems, flowers and fruits (Esplin 2007; Kneller 2003). Of great concern is the damage and destruction of seed pods and flowers, which decreases the reproductive success of individual plants (Esplin 2007; Kneller 2003). Plants with damaged stems will likely spend more energy on new vegetative growth than reproduction, thereby indirectly reducing sexual and asexual reproductive output.

Proponents of OHV use state that OHV use is beneficial for Welsh's milkweed since the recreational activity maintains the species' preferred habitat of open, active dunes (Kneller 2003). Furthermore, the benefit of maintaining or improving the habitat condition for the species may outweigh any physical damage to the plants (Palmer 2001). Some researchers have suggested that there may be some benefit to the species from OHV use by providing or maintaining suitable habitat, as indicated by the increasing stem counts at CPSD (Kneller 2003; Palmer 2001).

However, the inconclusive results of stem abundance monitoring at both populations do not provide enough information to support this assertion. Due to the problems with the stationary plots as originally established and the lack of data regarded the amount of OHV use in monitored plots, a large enough, reliable monitoring data set does not exist to determine exactly what the effect of OHV use is on stem count. Some data suggests it may cause a decrease in stem counts, and the 2002 census data indicates that it causes a decrease in sexual reproduction while possibly increasing the number of non-reproductive stems. Furthermore, if sexual reproduction is being impacted by OHV use, the number of unique individuals may be decreasing within the populations even as the existing plants increase vegetative stem production, potentially resulting in a long term loss of whatever genetic diversity may exist.

At the present time, data for OHV impact is limited to mentioning the presence of OHV tracks in the plot rather than a qualitative or quantitative ranking of OHV use over the season for the area in and adjacent to the plot. Data on OHV impact to plots and plants during or immediately after times of highest OHV use are largely absent because monitoring is typically conducted in August or September and constantly shifting sands erase OHV tracks (Esplin 2007, RMER 2011).

As Welsh's milkweed is a species that thrives on disturbance and prefers open areas free of other vegetation to grow, it is possible the OHV use does provide some indirect benefit to the population by keeping some areas open that would otherwise have become vegetated. However, any potential benefit of habitat creation must be weighed against the potential for physical damage to the plants, which may include a reduction in reproductive effort and a change in demography to the plants. In addition, continuous OHV disturbance to open dune areas could prevent the establishment of milkweed in new areas in a way that natural blowout of dune would not. OHV use at CPSD may be compatible with the long term survival and health of the Welsh's milkweed population. However, more research is required to determine the species response to OHV use, whether there is any benefit or whether benefits are outweighed by detrimental effects, and what degree of restriction (special or seasonal) on OHV use is adequate to protect the plants. In addition, good compliance to science-based regulations would need to be ensured.

We assign OHV use a **moderate** threat level at this time. Approximately 98% of stems (based on most recent census data) in the known population of Welsh's milkweed occur in designated critical habitat in CPSD, and 73% of that critical habitat in CPSD is open to OHV use (Kneller 2003, Service 2014). We do not know how many stems or stands are being protected by the OHV closure areas (Kneller 2003; Service 2014. This threat level was not ranked higher because the CPSD stem counts

increased in number which may or may not relate to a population increase, because protective measures requiring OHV users to stay at least ten feet away from vegetation exist on at least half of this population, and because OHV use is not a concern at the other seven known populations. However, more research into the long-term impact of OHVs on Welsh's milkweed is needed to determine the effects on individual and stand mortality, stand longevity, reproductive success, and genetic diversity. Because the CPSD population represents the vast majority of the species in existence, this threat will increase to high if new information indicates OHV use negatively impact on one or more of those factors. We will re-evaluate this threat when more information regarding OHV impact is available.

Grazing

All populations of Welsh's milkweed are on land that is open to grazing. Livestock (cattle) grazing is known to occur at three populations, CPSD, Sand Hills, and Comb Ridge. No evidence of grazing or livestock impact has been documented at the remaining five populations, although none of these are frequently visited or surveyed. Some trampling of plants was noted at CPSD, Sand Hills, and Comb Ridge, and at Comb Ridge evidence of grazing on Welsh's milkweed stems was also observed (Hazelton 2013, pers. comm.; Roth 2013, pers. comm.). Aside from these observations, there are no data on livestock impacts on Welsh's milkweed. However, the impact of grazing on the species is likely limited because livestock do not typically walk on the dunes where Welsh's milkweed grows unless they need to cross a dune field to reach new grazing areas (Roth 2013; Palmer 1993).

We consider livestock grazing to not be a threat at this time, as any stress to the plants from grazing appears to be extremely low. This would only be re-evaluated if there was an increase in grazing pressure on Welsh's milkweed habitat, or if additional evidence of livestock herbivory was documented in one or more of the populations.

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

Overutilization for commercial, recreational, scientific or educational purposes was not considered a threat at the time of listing, or in the recovery plan (Service 1992). Welsh's milkweed is not a plant of horticultural interest and is not collected for commercial purposes. It has no known medicinal value nor is it collected as a food source. Scientific collections for identification and documentation purposes have been minimal. A total of 37 specimens are located in regional herbaria and at the New York Botanical Garden (SEINet 2010). No seed germination

trials are underway and the species is not currently propagated offsite. Seeds are collected strictly for conservation purposes and are stored in CPC approved botanical gardens and storage facilities (Reisor 2014). Live plants were collected in the past for herbarium collections, but we are not aware of any ongoing collections. Overall, seed and plant collections only occur for conservation and recovery purposes. Therefore, we do not consider overutilization for commercial, recreational, scientific, or educational purposes to be a threat to the species.

2.3.2.3. Disease or predation.

Aside from livestock grazing, which was discussed in section 2.3.2.1, no other threats of disease or predation were mentioned in our final listing rule.

Insect Predation

Milkweed bugs (*Lygaeus* spp.) and milkweed beetles (*Tetraopes* spp.) have been observed feeding on plants within four Welsh's milkweed populations, CPSD, Sand Hills, Comb Ridge and Tuba City. Milkweed aphids (*Aphis nerii*) have also been observed feeding on Welsh's milkweed (Hazelton 2013, pers. comm.). These are all native insects that are common predators of other milkweed species and were likely historic predators of Welsh's milkweed. Damage to Welsh's milkweed plants from insect predation, primarily milkweed bug nymphs, includes damage to seedpods resulting in fruit desiccation and aborted or unviable seeds (Esplin 2006). This was particularly noted at CPSD in 2012 (RMER 2012).

However, no consistent reporting protocol for insect presence or damage has been in place. Due to the lack of consistent monitoring of most populations, the extent and full impact of insect predation throughout the range is not well understood. One study suggests that insect predation in combination with other stressors such as drought and OHV use may have an impact on Welsh's milkweed reproductive success, but not enough data exists to determine if this is so.

Because of the historic nature of the known predation and the lack of any conclusive evidence that predation is a significant stress on the species, we do not consider insect predation to be a threat based on current data. Monitoring efforts should strive to consistently document insect predation, and this assessment will be re-evaluated if such data showed significant loss of reproductive success or mortality due to insects.

2.3.2.4. Inadequacy of existing regulatory mechanisms

There were no species-specific Federal, State, or local laws or regulations that protected *Asclepias welshii* at the time of listing. Now that Welsh's milkweed is listed as a threatened species, the regulations of ESA provide some protections, and some regulatory protection is provided through the Federal Land Policy and Management Act (FLPMA) and the National Environmental Policy Act (NEPA).

Federal Laws and Regulations

The Act is the primary Federal law protecting Welsh's milkweed since its listing in 1987. Section 7(a) (1) states that Federal agencies, in consultation with us, shall carry out programs for the conservation of endangered species and threatened species. Section 7(a) (2) requires Federal agencies to consult with us to ensure any project they fund, authorize, or carry out is not likely to jeopardize the continued existence of listed species or modify their critical habitat. Jeopardy includes engaging in any action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR §402.02).

NEPA (42 U.S.C. 4371 et seq.) provides some protections for listed species that may be affected by activities undertaken, authorized, or funded by Federal agencies. Prior to implementation of such projects with a Federal nexus, the NEPA requires an agency to analyze the project for potential impacts to the human environment, including natural resources. In cases where the analysis reveals significant environmental effects, the Federal agency must discuss mitigation that could offset those effects (40 CFR 1502.16). These mitigations usually provide some protections for listed species. However, the NEPA does not require that adverse impacts be mitigated, only that impacts be assessed and the analysis disclosed to the public. In the absence of the Act's protections, it is unclear what level of consideration and protection Federal agencies would provide through the NEPA process.

FLMPA (Public Law 94-579) requires the BLM to allow a variety of uses on their land while simultaneously making an effort to preserve the natural resources (including plant species) therein. FLMPA guides BLM RMP development and grants the BLM authority to designate Wilderness and Wilderness Study Areas (WSAs). The WSAs contain undeveloped United States Federal land retaining its primeval character and influence, without permanent improvements or human habitation, and managed to preserve its natural conditions and protect their value until a determination can be made whether to designate them as official Wilderness areas. However, some WSAs, including Moquith Mountain WSA, allow activities which

would not be permitted in an official Wilderness area. Moquith Mountain WSA permits OHV access only on designated trails in most areas, as well as cross-country access to 1,190 ac (482 ha) in CPSD. Approximately half of designated critical habitat for Welsh's milkweed at CPSD (and the entire designated critical habitat at Sand Hills) falls in the BLM's Moquith Mountain Wilderness Study Area (BLM 1995). The remaining portion of the population is in CPSD State Park, administered by the State of Utah.

The Kanab BLM RMP prohibits OHV activity from a total of 316 ac (128 ha) in the Sand Hills area of the Moquith Mountain WSA in 2008 for the protection of Welsh's milkweed critical habitat and restricted OHV use in the remainder of the Sand Hills to existing routes only. However, 68% of designated critical habitat on the BLM-administered portion of CPSD is open to cross country travel by OHVs, provided they stay at least 10 feet away from vegetation, and an enforcement officer is posted locally although enforcement is not 100% (BLM 2008) In addition, the BLM banned OHV use on a total of 572 ac (231 ha) of its land in CPSD under a conservation agreement for the protection of the Coral Pink Sand Dunes tiger beetle, which overlaps in habitat with Welsh's milkweed (Conservation Committee 2013). This represents 32% of the total BLM-administered designated critical habitat for Welsh's milkweed at CPSD.

Four small populations occur in the BLM Paria Canyon-Vermilion Cliffs Wilderness (State Line, Coyote Buttes, Sand Cove, and Thousand Pockets), which is managed under the Paria Canyon-Vermilion Cliffs Wilderness Management Plan (WMP). In accordance with the Wilderness Act of 1964, these populations are closed to motorized vehicles (BLM 1987). This serves to decrease the likelihood these populations will be subject to negative impacts from human activities. These populations also fall under the BLM Arizona Strip RMP. Welsh's milkweed is mentioned in the RMP but no additional protections are provided (BLM 2008a)

State Laws and Regulations

Utah and Arizona have no State laws or regulations that protect Welsh's milkweed.

Navajo Nation Laws and Regulations

The Navajo Nation lists Welsh's milkweed as an endangered species under Group 3 on their endangered species list: A species or subspecies whose prospects of survival or recruitment are likely to be in jeopardy in the foreseeable future. They recommend a 200 foot buffer zone to avoid impacts, which may be more or less, depending on size and nature of the project (NNHP 2008). In addition, their Biological Resource Land Use

Clearance Policies and Procedures (RCP) places restrictions on development and land use based on assigned rankings of sensitivity depending upon the presence of threatened or endangered species and habitat condition. In most cases, a biological evaluation of the impacts to all species in the project area is required before development can occur (Navajo 2008). The Comb Ridge population is protected as Area 5 – Biological Preserve (no development unless compatible with the purpose of this area); the Tuba City population is protected as Area 1 – Highly sensitive (recommended no development with few exceptions) (Hazelton 2014).

While 100% of designated critical habitat at Sand Hills, covering the entirety of the population there, is closed to OHV use (BLM 2008; Church 2014b, pers. comm.), only 27% of designated critical habitat at CPSD, which makes up 98% of the stem count for Welsh's milkweed rangewide is now protected from OHV use (Service 2014). We do not know what percentage of the total number of stems are being protected in these two populations or the relationship between number of stems and number of individuals.

Additionally, the closure at Sand Hills has only been in place for 6 years and one third of the areas closed at CPSD have only been in effect in the past year, while OHV use in those areas occurred since at least 1989. We do not know how the historic use in now closed areas and how the current and historic use in areas open to OHV impacts the population of Welsh's milkweed or how it might continue to do so in the future. Although the stem counts at CPSD and Sand Hills have increased over the past 25 years, there are still substantial uncertainties regarding the effects of OHV use on the species. The remaining populations are protected by OHV closures, wilderness status, or inaccessibility. However, these seven populations only make up 2% of the total stem counts for the species. Thus, we feel that legal protections for this species outside of the ESA are not adequate at this time. In order for the legal protections to be considered adequate, additional research on OHV impact to the species and implementation of OHV regulations at CPSD based on the resulting data are needed.

We assign the inadequacy of existing regulatory mechanisms a **moderate** threat level at this time. This threat level may be reassessed if additional protections outside of the ESA are added to address threats and land protection within vulnerable populations.

2.3.2.5. Other natural or manmade factors affecting its continued existence

Vulnerability due to Small Population Sizes

Four of the eight populations of Welsh's milkweed are small in size and consist of 100 stems or less. These populations likely consist of far fewer genetically distinct individuals than 100. Population size is likely the best predictor of extinction rate for isolated populations (Fischer and Stöcklin 1997; Pimm *et al.* 1988). Small plant populations are 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; Wilcock and Neiland 2002), and are more likely to succumb to natural catastrophes (e.g., drought, fire, and flood) and environmental stochasticity (Fisher and Stocklin 1997).

Small population size in and of itself is not considered a threat for this species mostly because it can reproduce sexually and asexually; however, we consider small population size to increase the species' vulnerability to the threats discussed under sections 2.3.2.1through 2.3.2.5.

Climate Change

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). Much of the Southwest remains in a drought, recently assessed as the most severe western drought of the last 110 years (Karl *et al.* 2009). Water resources in the western United States are predicted to be sensitive to climate change (Karl *et al.* 2009). The levels of aridity of recent drought conditions are predicted to become the new climatology for the southwestern United States, and the most recent projections show the drought risk in this area for the remainder of the 21st century likely to reach unprecedented levels (Cook *et al.* 2015; Seager *et al.* 2007). Utah is expected to see longer periods between precipitation events, while those precipitation events become more intense (Steenburgh *et al.* 2007). Severe climate conditions have the potential to profoundly impact individuals, populations, and plant communities (Levine and Paige 2004).

The effects of climate change on Welsh's milkweed have not been directly studied. The species is considered drought tolerant in general, but seedling survival is likely diminished or unsuccessful under drought conditions. A severe, long term drought or increasing temperatures could impact the survival of individuals and their reproductive success.

We do not have enough data to accurately assess the threat level to this species from climate change at this time. We have no immediate evidence of a negative impact on Welsh's milkweed populations from climate change but this has not been studied so we do not fully understand it. We

will reassess the threat level once climate or species appropriate data indicates the population will be negatively impacted by future climate conditions.

2.4. Synthesis

At the time of listing, only two populations of Welsh's milkweed (CPSD and Sand Hills) were known from Utah. At the time of the Recovery Plan, three populations were known in Utah and Arizona (CPSD, Sand Hills and State Line, known then as Sand Cove) and the total population was estimated to be 11,000 stems (based on stem count). Today, the species comprises eight populations, and its range spans two states and nearly 150 miles. Our current estimate of the stem count for this species is approximately 72,000 stems, an increase from the initial estimate in the Recovery Plan of 11,000. This does not mean that the species population has increased. This increase is primarily due to more complete survey efforts at the CPSD population and the discovery of new populations. In addition, we do not know how and whether an increase in stem counts correlates to an increase in the number of individual plants. At the time of listing the primary threats to the species were considered OHV use, the inadequacy of existing regulatory mechanisms, and the restricted range and fragile habitat of the species.

We examined the same five factors we considered when we listed the species and identified any potential new threats we have not previously considered. Once these potential threats were identified, we systematically analyzed the impacts using the rankings components presented in Table 4. This allowed us to assess the factors in relation to the species' exposure and evaluate the relative importance of each potential threat to the species' persistence and recovery, allowing us to rank the threats in order of importance (Service 2006; Appendix A). The threat of OHV use was assessed and it was determined that these factors currently pose a moderate threat to the species. Livestock grazing and trampling and insect predation were also assessed and it was determined that these factors do not currently pose a threat to the species. The potential effect of climate change was also considered, but given our current state of knowledge, the threat level to this species could not be determined. Once we have greater knowledge of the species it will help us to understand how other threats may be impacting the species.

Although the range and total population size has increased since the publication of the Recovery Plan, some new populations are very small and others have not been fully surveyed. None of the recovery actions listed have been fully met, some are outdated or require additional scientific study in order to be met, and it is not clear they are adequate to protect the species from the high threat level of OHV use in its primary population. In addition, Despite years of monitoring, many basic facts about the life history, demographics, reproduction, genetics, and population dynamics remain unknown. Although total stem counts for the species are high, the vast majority of it is localized in one population at CPSD which is heavily used by OHVs; the long term impact to the species is still not fully understood. We have no reliable way to measure actual population size at this time. Smaller, more remote populations are more subject to stochastic events, and their loss could strongly impact the genetic diversity of the species.

These factors, plus our lack of scientific knowledge, particularly as it relates to population genetics, response of the species to threats, actual population size, and the lack of adequate protection for this species outside of the ESA do not make Welsh's milkweed a good candidate for delisting at this time.

This species may be a candidate for delisting in the future if research is able to determine or reliably approximate and distinguish the number of individuals in a population and if population levels are stable or increasing in the face of current threats. In addition, specific research on the impact of OHV use to Welsh's milkweed should be conducted, OHV regulations based on the resulting data should be implemented and reliably enforced at CPSD, and individual and population-level responses to drought should be further studied to determine the threat level of climate change on this species prior to proposal for delisting. The future discovery of additional populations of Welsh's milkweed or a full census of the Tuba City and Comb Ridge populations that would document them making up a larger proportion of the total species population than previously thought (and thus reducing the impact of threats to the CPSD population of the species as a whole) could also make this species suitable for delisting consideration in the future.

3. RESULTS

☐ Downlist to Species of Concern
☐ 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

4. RECOMMENDATIONS FOR FUTURE ACTIONS

These items are categorized by type. Highest priority actions are **bolded**.

4.1. Surveys and Monitoring

- **We recommend continued monitoring of the existing plots at Coral Pink Sand Dunes, with a focus on refining a protocol that takes into account the changing location of dunes and monitored stands and meaningfully measures the impact of OHV use, while returning consistent results that can be compared across years**

- **Data on the presence and intensity of OHV activity in the plots and any damage should continue to be collected and recorded in a standardized, quantifiable form, and monitoring protocols should be expanded to more fully capture the total OHV usage over a season in monitored plots as opposed to only the most recent usage once per season.**

- **We recommend that targeted surveys of previously un-surveyed likely suitable habitat be conducted for Welsh's milkweed in, and detailed records kept of what locations have been surveyed.**

- **We recommend that all known populations be surveyed regularly with standardized and accurate methodology in order to obtain baseline population data, and that a targeted, scientifically-meaningful, range-wide monitoring scheme be developed and implemented**

- We recommend that monitoring protocol include provisions to distinguish new rhizomatous growth from true seedlings, and that the delineation of stem classes (particularly between secondary and mature stems) be made clear and consistently applied, including consideration of whether classifying stems as secondary is scientifically useful – a categorization such as seedling, primary stem, non-reproductive stem, reproductive stem may hold more value and be easier to apply.

- We recommend that monitoring data collected be expanded to include the presence of predatory insects on plants, damage observed, number of first year seedlings, and the number of desiccated or abortive seedpods vs healthy seed pods.

- We recommend that the Navajo Nation develop a monitoring plan for the Welsh's milkweed populations at Tuba City and Comb Ridge, to ensure that those populations are adequately surveyed and to assess what threats they face currently or may face in the future.

- We recommend that GIS data from the 2002 census at CPSD showing milkweed stand number and location in 1992 and 2002 be located and used to guide future surveying or censusing efforts at CPSD. If this data cannot be located, we recommend it be reconstructed by hand and digitized using existing maps from the 2002 census.

- We recommend that a census of the CPSD similar to the one performed in 2002 be completed to determine locations of stands, amount of occupied habitat, and what level of protection current closure areas are providing for that population.

4.2. Research

- We recommend that the BLM, State of Utah, and the Navajo Nation conduct research on Welsh's milkweed with the following goals.

    - **Determine the current level of OHV use in and on existing stands and how that use relates to species response and impacts on individual mortality, reproductive success, and population demographics, particularly during high traffic times of the season. Monitoring should evaluate plant and reproductive damage in low, medium, and high OHV use areas and ultimately determine the overall detriment to the species from OHV use. This should be weighed against any benefit from OHV disturbance in the form of habitat creation, with the purpose of creating science-based OHV regulations within CPSD that are adequate for the protection of Welsh's milkweed.**

    - Assess the genetic variability of the species across the range and within populations in order to understand the population genetics of Welsh's milkweed.

    - Genetic or other research should identify individual plants within a stand and develop protocols to distinguish individuals so monitoring methods follow individuals through time and so actual population size can be determined.

- Determine the mechanisms of species population dynamics including why certain populations appear to have declining stem counts, and whether those which appear to be increasing are actually increasing in number of individuals or only in stem counts.

- Gain a more complete understanding of the life history of Welsh's milkweed, particularly as it pertains to sexual reproduction, seedling recruitment, life span, and stem demographics, in order to be able to monitor the health and status of the populations effectively.

- Study the breeding biology, pollinators of the species and pollinator requirements for the species. Identify other community associates that may be important for the species (i.e. those species that support pollinators and provide corridors for pollinators).

- Study how and when Welsh's milkweed reproduces sexually and asexually.
- Determine the species' vulnerability to prolonged drought, temperature change, and the potential impacts of climate change, including impact on pollinators of Welsh's milkweed.

4.3. Ex-situ Conservation

- Red Butte Garden, or another qualified and permitted botanical garden, should collect seeds from all or the majority of populations to develop ex-situ populations of the species and long-term storage.

- Red Butte Garden, or another qualified and permitted entity, should research techniques needed to successfully propagate the species should we determine reestablishing populations in the wild is a viable recovery action.

4.4. Education

- We recommend CPSD State Park continue to develop educational materials regarding rare plants, their unique relationship to the local geology, and their conservation, as well as materials promoting responsible OHV use in Welsh's milkweed habitat.

- We recommend Red Butte Garden develop educational materials regarding rare plants, their conservation, and conservation efforts performed by their institution.

- We recommend the Navajo Nation develop educational materials regarding local rare plants, including Welsh's milkweed, to increase awareness of the plants and their conservation on Navajo lands.

- We and the BLM should develop fact sheets and educational materials in schools, agency offices, and visitor centers to facilitate appreciation of and respect for sensitive areas which may contain habitat for threatened or endangered plants.

4.5. Threat Abatement

- **We recommend that the BLM and Coral Pink Sand Dune State Park develop a joint management plan for the Coral Pink Sand Dunes ecosystem as a whole and –include conservation measures for Welsh's milkweed specifically. Such a plan would implement the research described in Section 4.2 in creating adequate protections from threats for Welsh's milkweed within CPSD, including OHV regulations that would protect the species while also preferably allowing continued recreational OHV use of the dunes.**

- We recommend that at least an additional 218 ac (88 ha) of BLM land in CPSD should be closed to OHVs specifically to provide protection for Welsh's milkweed and fulfil the Kanab RMP management action SSS-44. Depending on the results of additional surveys and assessments of the total acreage and location of occupied habitat at CPSD (see section 4.2, Research, above), additional acreages may also require protection from OHV use.

- We recommend that the BLM and CPSD State Park consider establishing additional permanent or seasonal OHV closure areas in Coral Pink Sand Dunes and Sand Hills, targeting areas where high OHV traffic intersects with Welsh's milkweed stands, particular during the species' fruiting and flowering time.

4.6. Administrative Actions

- **The Service should revise the Recovery Plan to explicitly address the relevant listing factors. The revised Recovery Plan should include objective, measurable criteria which, when met, will result in a determination that the species be removed from the Federal List of Endangered and Threatened Plants. The Recovery Plan also should estimate the time required and the cost to carry out those measures needed to achieve the goal for recovery and delisting. The Recovery Plan should include updated range and population numbers and should provide recognition for new and/or increased threats since the time of listing.**

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW OF WELSH'S MILKWEED

Current Classification: Threatened range-wide

Recommendation resulting from the 5-Year Review:

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

Review Conducted By:

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approve _____ Date 11/23/2015
Field Supervisor
Utah Ecological Services Field Office

Cooperating Field Supervisor, Fish and Wildlife Service

Approve _____ Date 12/10/15
Field Supervisor
Arizona Ecological Services Field Office

REGIONAL OFFICE APPROVAL:

Lead Assistant Regional Director, Fish and Wildlife Service

Approve _____ Date 12/4/15
Assistant Regional Director
Region 6

Cooperating Assistant Regional Director, Fish and Wildlife Service

Approve _____ Date 12/11/15
Assistant Regional Director
Region 2

APPENDIX A

Welsh's milkweed (*Asclepias welshii*)
Threats, Stressors, and Their Associated Scope, Immediacy, Intensity, Exposure, Response, and Overall Threat Level

	Threat[10]/ Potential Threat[11]	Stressor[12]	Factor[13]	Scope[14]	Immediacy[15]	Intensity[16]	Exposure[17]	Response[18]	Overall Threat Level[19]
1	OHV Use	Direct physical injury	A	Moderate	Historic/ Imminent/ Future	Moderate	High	Basic need inhibited & mortality	Moderate
2		Decreased reproductive success	A	Moderate	Historic/ Imminent/ Future	Moderate	High	Basic need inhibited	Moderate
3	Grazing and Trampling	Direct physical injury	A	Moderate	Historic/ Imminent/ Future	Low	Small	Basic need inhibited	No threat at present
4	Insect predation	direct physical injury / mortality to individuals	C	Moderate	Imminent/ Future	Low	Small	Basic need inhibited	No threat at present
5	Lack of (or inefficiency of) existing regulatory mechanisms independent of Act	Insufficient protective measures	D	Moderate	Historic/ Imminent/ Future	Moderate	Moderate	Basic need inhibited & Mortality	Moderate
6	Small Populations	Loss of genetic diversity and resiliency	E	Moderate	Imminent / Future	Moderate	Moderate	Basic need inhibited & Mortality	Moderate[20]
7	Climate Change	Changes in hydrological conditions, habitat conditions	E	Rangewide	Imminent / Future	Low	High	Basic need inhibited	Low

10: Any circumstance or event that is causing or will cause harm to the resource.
11: Any circumstance or event with the potential to cause harm to the resource.
12: A process or event with negative impact on target species.
13: Same factors used when making a listing decision: A – The present or threatened destruction, modification, or curtailment of its habitat or range; B – Overutilization for commercial, recreational, scientific, or educational purposes, C – Disease or predation; D – The inadequacy of existing regulatory mechanisms; or E – Other.
14: Geographic extent of the stressor: Localized – less than one population; Moderate – one population; or Rangewide – stressor is acting on species rangewide.
15: Timeframe of the stressor: Imminent – is the stressor present and acting on the target now; Future – anticipated in the future; or Historic – or has the impact already occurred.
16: The strength of the stressor itself: Low, Moderate, or High.
17: The extent to which a target resource and stressor actually overlap in space and/or time given the scope: Small, Moderate, or High.
18: Level of physiological / behavioral response due to a specific stress considering growth, fecundity, and mortality rates: Basic need inhibited – basic plant needs for growth & development; or Mortality – identifiable reduction in growth rate or survival.
19: Integration of the scope, immediacy, intensity, exposure, and response at the species level: Potential, Low, Moderate, or High.
20: Small population size in and of itself is not considered a threat; however, it may increase the species' vulnerability if other threats are impacting the species.