AUTHENTICATED
U.S. GOVERNMENT
INFORMATION
GPO

FEDERAL REGISTER

Vol. 77 Wednesday,
No. 192 October 3, 2012

Part II

Department of the Interior

Fish and Wildlife Service

50 CFR Part 17

Endangered and Threatened Wildlife and Plants; 12-Month Finding for the Lemmon Fleabane; Endangered Status for the Acuña Cactus and the Fickeisen Plains Cactus and Designation of Critical Habitat; Proposed Rule

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS–R2–ES–2012–0061; 4500030113]

RIN 1018–AY51

Endangered and Threatened Wildlife and Plants; 12-Month Finding for the Lemmon Fleabane; Endangered Status for the Acuña Cactus and the Fickeisen Plains Cactus and Designation of Critical Habitat

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Proposed rule; 12-month finding.

SUMMARY: We, the U.S. Fish and Wildlife Service (Service), announce a 12-month finding on a petition to list as an endangered or threatened species *Erigeron lemmonii* (Lemmon fleabane). After a review of the best available scientific information we find that listing the Lemmon fleabane as an endangered or threatened species is no longer warranted, and therefore we are removing this species from the candidate list. We propose to list *Echinomastus erectocentrus* var. *acunensis* (acuña cactus) and *Pediocactus peeblesianus* var. *fickeiseniae* (Fickeisen plains cactus) as an endangered species, and we propose to designate critical habitat for both cactus species under the Endangered Species Act of 1973, as amended (Act). If finalized, the effect of these regulations would be to add acuña cactus and Fickeisen plains cactus to the List of Endangered and Threatened Plants and to designate critical habitat for these species.

DATES: We will accept comments received or postmarked on or before December 3, 2012. Comments submitted electronically using the Federal eRulemaking Portal (see **ADDRESSES** section, below) must be received by 11:59 p.m. Eastern Time on the closing date. We must receive requests for public hearings, in writing, at the address shown in the **FOR FURTHER INFORMATION CONTACT** section by November 19, 2012.

ADDRESSES: You may submit comments by one of the following methods:

(1) *Electronically:* Go to the Federal eRulemaking Portal: *http://www.regulations.gov*. In the Keyword box, enter Docket No. FWS–R2–ES–2012–0061, which is the docket number for this rulemaking. Then, in the Search panel on the left side of the screen, under the Document Type heading, click on the Proposed Rules link to locate this document. You may submit a comment by clicking on ''Comment Now!''

(2) *By hard copy:* Submit by U.S. mail or hand-delivery to: Public Comments Processing, Attn: FWS–R2–ES–2012–0061; Division of Policy and Directives Management; U.S. Fish and Wildlife Service; 4401 N. Fairfax Drive, MS 2042–PDM; Arlington, VA 22203.

We request that you send comments only by the methods described above. We will post all comments on *http://www.regulations.gov*. This generally means that we will post any personal information you provide us (see the Information Requested section below for more information).

The coordinates or plot points or both from which the critical habitat maps are generated are included in the administrative record for this rulemaking and are available at *http://www.fws.gov/southwest/es/arizona/, http://www.regulations.gov* at Docket No. FWS–R2–ES–2012–0061, and at the Arizona Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**). Any additional tools or supporting information that we may develop for this rulemaking will also be available at the Fish and Wildlife Service Web site and Field Office set out above, and may also be included in the preamble and/or at *www.regulations.gov*.

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

SUPPLEMENTARY INFORMATION:

Executive Summary

Why we need to publish a rule. Under the Endangered Species Act of 1973, as amended a species may warrant protection through listing if it is an endangered or threatened species throughout all or a significant portion of its range. The Act sets forth procedures for adding species to, removing species from, or reclassifying species on the Federal Lists of Endangered and Threatened Wildlife and Plants. This document consists of a 12-month not-warranted finding and withdrawal of *Erigeron lemmonii* (Lemmon fleabane) from the candidate list, and a proposed rule to list *Echinomastus erectocentrus* var. *acunensis* (acuña cactus) and *Pediocactus peeblesianus* var. *fickeiseniae* (Fickeisen plains cactus) as endangered species and to designate critical habitat. For the remainder of this document, these species will be referred to by their common names.

The Endangered Species Act provides the basis for our action. Under the Act, we can determine that a species is an endangered or threatened species based on any of five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence.

We have determined that the Lemmon fleabane does no longer warrant listing. Through our five factor analysis, we have determined that the previously recognized threats to the Lemmon fleabane do not rise to a level of significance such that the species is in danger of extinction now or likely to become so in the foreseeable future.

We have determined that the following are threats to the acuña cactus:

- United States—Mexico border activities including inadequacy of regulatory mechanisms, and
- Predation by native insect and small mammal predators, in combination with other natural or manmade factors, including natural environmental variability and climate conditions such as drought.

We have determined that the following are threats to the Fickeisen plains cactus:

- Livestock grazing;
- Nonnative, invasive species; and
- Predation by native small mammal predators, in combination with other natural or manmade factors, including natural environmental variability and climate conditions such as drought.

This rule also proposes designation of critical habitat for both species. Under the Act, we must, to the maximum extent prudent and determinable, designate critical habitat for any species that is determined to be an endangered or threatened species. We are required to base the designation on the best available scientific data after taking into consideration economic and other impacts. We can exclude an area from critical habitat if the benefits of exclusion outweigh the benefits of designation, unless the exclusion will result in the extinction of the species. In total, we are proposing approximately 21,740 hectares (ha) (53,720 acres (ac)) for designation as critical habitat for

acuña cactus (Table 1) and approximately 19,901 ha (49,186 ac) for the Fickeisen plains cactus (Table 2). The proposed critical habitat for acuña cactus is located in Maricopa, Pima, and Pinal Counties, Arizona. The proposed critical habitat for the Fickeisen plains cactus is in Coconino and Mohave Counties, Arizona.

TABLE 1—PROPOSED CRITICAL HABITAT FOR THE ACUÑA CACTUS

Federal	State	Tribal	Private	Total
Ha (Ac)	Ha (Ac)	Ha (Ac)	Ha (Ac)	Ha (Ac)
11,953 (29,536)	5,773 (14,266)	2,256 (5,575)	1,757 (4,342)	21,740 (53,720)

TABLE 2—PROPOSED CRITICAL HABITAT FOR THE FICKEISEN PLAINS CACTUS

Federal	State	Tribal	Private	Total
Ha (Ac)	Ha (Ac)	Ha (Ac)	Ha (Ac)	Ha (Ac)
6,671 (16,486)	5,617 (13,883)	3,865 (9,554)	3,748 (9,263)	19,901 (49,186)

We are preparing an economic analysis. To ensure that we consider the economic impacts of designating critical habitat, we are preparing an economic analysis of the proposed designation.

We will seek peer review of the methods we used in our proposal. We are seeking comments from independent specialists to ensure that our proposal is based on scientifically sound data, assumptions, and analyses.

We are seeking public comment on this proposed rule. Anyone is welcome to comment on our proposal or provide additional information on the proposal that we can use in making a final determination on the status of these species.

Information Requested

We intend that any final action resulting from this proposed rule will be based on the best scientific and commercial data available and be as accurate and as effective as possible. Therefore, we request comments or information from other concerned governmental agencies, Native American tribes, the scientific community, industry, or any other interested parties concerning this proposed rule. We particularly seek comments concerning:

(1) These species' biology, range, and population trends, including:

(a) Habitat requirements for pollination, reproduction, and dispersal;

(b) Genetics and taxonomy;

(c) Historical and current range including distribution patterns;

(d) Historical and current population levels, and current and projected trends; and (e) Past and ongoing conservation measures for these species, their habitat or both.

(2) The factors that are the basis for making a listing determination for a species under section 4(a) of the Act (16 U.S.C. 1531 *et seq.*), which are:

(a) The present or threatened destruction, modification, or curtailment of their habitat or range;

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

(c) Disease or predation;

(d) The inadequacy of existing regulatory mechanisms; or

(e) Other natural or manmade factors affecting their continued existence.

(3) Biological, commercial trade, or other relevant data concerning any threats (or lack thereof) to these species and existing regulations that may be addressing those threats.

(4) Additional information concerning the historical and current status, range, distribution, and population size of these species, including the locations of any additional populations of these species.

(5) Any information on the biological or ecological requirements of the species, and ongoing conservation measures for the species and its habitat;

(6) The reasons why we should or should not designate habitat as ''critical habitat'' under section 4 of the Act (16 U.S.C. 1531 *et seq.*), including whether there are threats to these species from human activity, the degree of which can be expected to increase due to the designation, and whether that increase in threats outweighs the benefit of designation such that the designation of critical habitat is not prudent.

(7) Specific information on:

(a) The amount and distribution of these species and their habitat;

(b) What may constitute ''physical or biological features essential to the conservation of these species,'' within the geographical range currently occupied by these species;

(c) Where these features are currently found;

(d) Whether any of these features may require special management considerations or protection;

(e) What areas, that were occupied at the time of listing (or are currently occupied) and that contain features essential to the conservation of these species, should be included in the designation and why;

(f) What areas not occupied at the time of listing are essential for the conservation of these species and why.

(8) Land use designations and current or planned activities in the areas occupied by these species or proposed to be designated as critical habitat, and possible impacts of these activities on these species and proposed critical habitat.

(9) Information on the projected and reasonably likely impacts of climate change on these species and proposed critical habitat.

(10) Any foreseeable economic, national security, or other relevant impacts that may result from designating any area that may be included in the final designation. We are particularly interested in any impacts on small entities, and the benefits of including or excluding areas from the proposed designation that are subject to these impacts.

(11) Whether our approach to designating critical habitat could be improved or modified in any way to provide for greater public participation and understanding, or to assist us in

accommodating public concerns and comments.

(12) The likelihood of adverse social reactions to the designation of critical habitat and how the consequences of such reactions, if likely to occur, would relate to the conservation and regulatory benefits of the proposed critical habitat designations.

(13) Information on certain populations of Fickeisen plains cactus. Specifically, there are eight populations where the Fickeisen plains cactus has been documented, but these areas have not been visited in over 18 years. Five populations are located on the Arizona Strip and are referred to as: Beanhole Well, Marble Canyon, Salaratus Draw, South Canyon, and Toquer Tank. The sixth population is located in proximity to Mays Wash that is south of the Town of Gray Mountain among Federal, State, and private lands. The last two populations are on the Navajo Nation. These eight areas are proposed as critical habitat for the Fickeisen plains cactus. We are seeking any information on specific population status of the Fickeisen plains cactus at these locations, whether these locations are currently occupied and contain the features essential to the conservation of the species, and the condition of the habitat.

Please include sufficient information with your submission (such as scientific journal articles or other publications) to allow us to verify any scientific or commercial information you include.

Please note that submissions merely stating support for or opposition to the action under consideration without providing supporting information, although noted, will not be considered in making a determination, as section 4(b)(1)(A) of the Act directs that determinations as to whether any species is an endangered or threatened species must be made ''solely on the basis of the best scientific and commercial data available.''

You may submit your comments and materials concerning this proposed rule by one of the methods listed in the **ADDRESSES** section. We request that you send comments only by the methods described in the **ADDRESSES** section.

If you submit information via *http://www.regulations.gov,* your entire submission—including any personal identifying information—will be posted on the Web site. If your submission is made via a hardcopy that includes personal identifying information, you may request at the top of your document that we withhold this information from public review. However, we cannot guarantee that we will be able to do so. We will post all hardcopy submissions on *http://www.regulations.gov.* Please include sufficient information with your comments to allow us to verify any scientific or commercial information you include.

Comments and materials we receive, as well as supporting documentation we used in preparing this proposed rule, will be available for public inspection on *http://www.regulations.gov,* or by appointment, during normal business hours, at the U.S. Fish and Wildlife Service, Arizona Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**).

Organization of Document

The layout of this rule is as follows: The 12-month not-warranted petition finding and candidate withdrawal for the Lemmon fleabane; the proposed listing of the acuña cactus and the Fickeisen plains cactus; the proposed critical habitat for the acuña cactus and the Fickeisen plains cactus.

12-Month Petition Finding and Candidate Withdrawal for the Lemmon Fleabane

This section summarizes the status and potential threats that we evaluated in order to determine that listing Lemmon fleabane is not-warranted and to remove it from candidate status. Additional material that we relied on is available in the Species Assessment and Listing Priority Assignment Form for Lemmon fleabane. This form is available on our national endangered species Web site: *http://www.fws.gov/endangered/* (search for ''Lemmon fleabane'' in the Species Search box).

On July 1, 1975 (40 FR 27824), the Lemmon fleabane was included among 3,000 plant species under status review. We first identified the Lemmon fleabane as a category 1 candidate species on September 30, 1993 (58 FR 51144). Candidates are those fish, wildlife, and plants for which we have on file sufficient information on biological vulnerability and threats to support preparation of a listing proposal, but for which development of a listing regulation is precluded by other higher priority listing activities. Candidate species were assigned a relative listing priority number in accordance with listing priority guidelines published on September 21, 1983 (48 FR 43098). On the basis of immediacy and magnitude of threats, as well as taxonomic status, we assigned the Lemmon fleabane a listing priority number (LPN) of 11, which is assigned when threats are of moderate to low magnitude and non-imminent. On October 25, 1999, we changed the LPN to a 5 to reflect threats that are of high magnitude but non-imminent, based on the threat of high severity fire and drought (64 FR 57534). Later, we decided a wildfire or drought would not adversely affect the entire population; therefore, on September 12, 2006, we changed the LPN to an 8, reflecting threats that are of moderate to low magnitude and imminence (71 FR 53756), and this LPN remained in effect until the last Candidate Notice of Review in 2011 (76 FR 66370, October 26, 2011). We now find that listing this species is not-warranted, and we are withdrawing this species from candidate status because the previously recognized threats to the Lemmon fleabane do not rise to the level of significance such that the species is in danger of extinction now or likely to become so in the foreseeable future. Our rationale is explained below.

The Lemmon fleabane is a tap-rooted perennial plant of the aster family (Nesom 2006, p. 342). The Lemmon fleabane occurs in crevices and ledges, on all aspects of tall, vertical-faced, and very cuspid (pointed) Escabrosa limestone cliffs of a single canyon, Scheelite Canyon, on Fort Huachuca on Department of Defense lands, in Cochise County, Arizona (Warren *et al.* 1991, p. 5; Malusa 2006, pp. 9–11). The habitat occurs over an area of approximately 50 ha (124 ac), and, as of 2006, the population is estimated to support 954 individuals (Malusa 2006, p. 9).

The primary threat previously identified for the Lemmon fleabane was high severity wildfire, a phenomenon outside of the established fire history for the forests of the Huachuca Mountains. Scheelite Canyon is a narrow, shady, bedrock-laden cold-air-drainage, with higher humidity and cooler temperatures than surrounding areas; these factors aid in limiting the spread of severe fire within the canyon (Turner and Romme 1994, p. 59; Gebow and Hessil 2006, p. 21; Werth *et al.* 2011, p. 27). In addition, Scheelite Canyon is a southeast to northwest configured canyon that blocks prevailing southwesterly wind. Strong southwesterly wind was a necessary component in the unusual fire behavior documented in recent high severity fires of the Huachuca Mountains, where southwest to northeast configured canyons burned downslope and burned very hot (Leiendecker 2012, pers. comm.).

Although Scheelite Canyon currently contains a woody fuel load, fire experts believe the Lemmon fleabane itself is relatively safe from fire (Gebow and Hessil 2006, p. 51; Leiendecker 2012, pers. comm.). Recent documentation of two other rare, cliff-dwelling *Erigeron* species of the Chiricahua Mountains of

southern Arizona indicates that plants growing in cracks within the rockwall may be both resistant and resilient to high severity fire (Malusa 2012, pers. comm.). In the unlikely event of a catastrophic fire within Scheelite Canyon, it would be extremely unlikely that every Lemmon fleabane plant would be extirpated. This is because Lemmon fleabane plants occur on all aspects of rock face, on both sides of the canyon including the entrances of small tributaries, and at all elevations on the canyon wall from the canyon bottom upwards nearly 305 meters (m) (1,000 feet (ft)) to the top of the canyon walls.

In summary, there is a very small probability that Scheelite Canyon will sustain a catastrophic fire in the future due to the southeast to northwest aspect of the canyon in the landscape; its humid, shady, and cool nature; and the presence of exposed rock outcroppings throughout the canyon lending to a discontinuous fuel load. Should such a fire occur, it would threaten individual plants exposed to flame and heat (Gebow and Hessil 2006, p. 85); however, due to the plants occurring in a variety of locations within the canyon, it is unlikely that all plants would be affected.

Recreational rappelling was noted as a minor threat to the Lemmon fleabane; however, we conclude that there is a very low probability of this type of activity taking place in Scheelite Canyon because recreational rappelling is not allowed by Fort Huachuca. Further, if unauthorized rappelling were to occur, the damage to Lemmon fleabane plants would be insignificant at the population level.

In addition to fire and rappelling posing less of a threat to the Lemmon fleabane than previously believed, several conservation measures have recently occurred or are being planned. Although we did not rely on these conservation measures to make our not-warranted finding, they are underway and will benefit the Lemmon fleabane now and into the future. In 2011, the Desert Botanical Garden collected hundreds of viable Lemmon fleabane seeds for long-term storage. This collection and future-planned seed collection by the Desert Botanical Garden may help offset impacts to the species in the event of a devastating wildfire and habitat loss. In addition, the U.S. Forest Service is currently working with Fort Huachuca to reduce fire potential at a landscape level throughout the district and on Fort Huachuca itself (Leiendecker 2012, pers. comm.). Finally, Fort Huachuca and the Service are drafting a conservation agreement which, once signed, will: (a) Ensure the continued monitoring of the Lemmon fleabane population and promote adaptive management based on monitoring results; (b) continue the restrictions on recreational activities in Lemmon fleabane habitat; and (c) encourage further research into the species' life history, population biology and demographics, and distribution.

Through our five-factor analysis, we have discounted any threats to the species and conclude there are no significant threats to the Lemmon fleabane. We, therefore, conclude that the previously recognized threats to the Lemmon fleabane do not rise to a level of significance such that the species is in danger of extinction now or in the foreseeable future. Additionally, we are not aware of any other potential stressors or threats that may impact the species or its habitat by itself or in combination, including the potential environmental effects that may result from climate change. Current and planned conservation measures will also benefit the Lemmon fleabane, although we are not relying on these conservation actions as the basis for our not-warranted finding. As a result, we have removed this species from the candidate list.

Acuña Cactus and Fickeisen Plains Cactus

Previous Federal Actions

On July 1, 1975 (40 FR 27824), we published a Review of Status of Vascular Plants identifying the acuña cactus and the Fickeisen plains cactus as among 3,000 native plant taxa being reviewed for possible inclusion in the list of endangered and threatened species. On December 15, 1980, we published a Review of Plant Taxa for Listing as Endangered or Threatened Species and identified the Fickeisen plains cactus as category 1 species (45 FR 82480). Category 1 species were those taxa for which we had on file substantial information on biological vulnerability and threats to support proposing them as endangered or threatened species. The acuña cactus was not included in the 1980 notice. Both the acuña cactus and the Fickeisen plains cactus were included in the February 21, 1990, notice (55 FR 6184) as category 1 species.

In the September 30, 1993, notice (58 FR 51144) candidate species were assigned a status category indicating their status at that time. Each species was identified as increasing (I), stable (S), declining (D), or unknown (U). The 1993 notice identified the acuña cactus and the Fickeisen plains cactus as category 1–U: unknown, denoting species for which additional survey work is required to determine current trends.

We discontinued the use of a category system in the February 28, 1996, notice (61 FR 7596) and simply referred to category 1 species as candidate species. The acuña cactus and Fickeisen plains cactus were both assigned an LPN of 6, due to the high magnitude of threats which were non-imminent. We published four Candidate Notice of Reviews between 1997 and 2003, in which the acuña cactus and the Fickeisen plains cactus remained candidate species with an LPN of 6 (62 FR 49398, September 19, 1997; 64 FR 57534, October 25, 1999; 66 FR 54808, October 30, 2001; 67 FR 40657, June 13, 2002).

On October 30, 2002, we received a petition from the Center for Biological Diversity to list the acuña cactus as an endangered species under the provisions of the Act. On May 4, 2004, the Center for Biological Diversity petitioned the Service to list the acuña cactus and the Fickeisen plains cactus as an endangered species under the Act. Because these species were already candidates for listing, we did not issue findings on the petition. In the Candidate Notice of Review dated September 12, 2006 (71 FR 53756), we revised the LPN of the Fickeisen plains cactus from 6 to 3 based on direct mortality and reduced reproductive capacity resulting from off-road vehicle (ORV) use, trampling associated with livestock grazing, a continuing drought, and herbivory by rabbits and rodents. We also acknowledged that unauthorized collection of the Fickeisen plains cactus was a potential threat but we did not know at that time whether it was a continuing threat. In the notice of December 6, 2007 (72 FR 69034), we revised the LPN of the acuña cactus from 6 to 3 based on continued decline of the species caused by ongoing drought. An LPN of 3 reflects threats that are both imminent and high in magnitude, as well as the taxonomic classification as a subspecies. In plant classification generally, the use of the term variety, such as is used in the plants in this rule, is synonymous with the term subspecies. In the notice of October 26, 2011 (76 FR 66370), we retained an LPN of 3 for both species.

Background

For each of the two cactus species, we provide a description of the species, its life history, its habitat, an evaluation of listing factors for that species, and our finding for the species.

Acuña Cactus

It is our intent to discuss below only those topics directly relevant to the listing of the acuña cactus as an endangered species in this section of the proposed rule.

Species Description

The acuña cactus is a small, spherical cactus, usually single-stemmed, that can be up to 40 centimeters (cm) (16 inches (in)) tall and 9 cm (3.5 in) wide (Arizona Rare Plant Guide Committee 2001, unpaginated; Zimmerman and Parfitt 2003, pp. 194–195). The acuña cactus has 11 to 15 radial spines up to 2.5 cm (1.0 in) long and 3 to 4 mauve-colored, up-turned central spines up to 3.5 cm (1.4 in) long (Arizona Rare Plant Guide Committee 2001, unpaginated; Zimmerman and Parfitt 2003, pp. 194–195). Rose, pink, or lavender flowers 3.6 to 6 by 4 to 9 cm (1.4 to 2.3 by 1.6 to 3.5 in) are produced in March (Arizona Rare Plant Guide Committee 2001, unpaginated; Zimmerman and Parfitt 2003, pp. 194–195). The fruits are pale green, are 1.25 cm (0.5 in) long, and contain small, nearly black seeds (Felger 2000, p. 208). The fruits ripen in April (Arizona Rare Plant Guide Committee 2001, unpaginated).

Biology

The acuña cactus relies solely on the production of seeds for reproduction, with pollination highly linked to survival, as the species cannot fertilize itself. Acuña cacti are pollinated by a suite of bees from the Andrenidae, Anthophoridae, Anthophorinae, Halictidae, and Megachilidae families; however, the leafcutter bee (*Megachile palmensis*) and cactus bee (*Diadasia rinconis*) are thought to be the primary pollinators (Johnson 1992, p. 406). The maximum distance that either of these bees travel is thought to be roughly 900 m (2,953 ft) (see Critical Habitat section, below).

Although we do not know the lifespan of acuña cacti, there are individual plants that have been tracked at Organ Pipe Cactus National Monument (OPCNM) since 1977, and are still alive in 2012 (Holm 2012a, pers. comm.). The lifespan of seeds in the seedbank is unknown; however, in independent greenhouse tests of 6 and 4 year-old seed collected from two discrete populations, less than 19 percent and zero percent germination resulted, respectfully (Rutman 2007, p. 7). In tests of 1 and 2 year-old seed, germination ranged from 64 to 100 percent, and tests of seed collected 19 days previously resulted in 82 percent germination (Rutman 2007, p. 7). It is unknown if seed in its natural environment has the same short lifespan as has been demonstrated in these germination trials.

Taxonomy

This species was originally described in 1953 by W.T. Marshall as *Echinomastus acunensis* (Marshall 1953, pp. 33–34). It is known by many synonyms, including *Sclerocactus erectocentrus* var. *acunensis* (Coulter) Taylor and *Neolloydia erectocentra* (W.T. Marshall) var. *acunensis* L. Benson (Arizona Game and Fish Department (AGFD) 2004, p. 1). The Cactaceae treatment in the Flora of North America (Zimmerman and Parfitt 2003, pp. 194–195) recognizes the entity as *E. erectocentrus* var. *acunensis.* The other variety, *E. erectocentrus* var. *erectocentrus* (needle-spine cactus), is also recognized as a valid taxon in the Flora of North America. The two varieties are generally considered to be morphologically distinct and geographically isolated, but there have been questions regarding the morphology of some individuals (AGFD 2004, p. 6). To address those concerns, the Service funded a project to analyze the morphological distinctness of the two varieties, which was completed in January 2007. The results of this study suggest that there are four distinct taxonomic groups, including the separation of variety *acunensis* and variety *erectocentrus* (Baker 2007, pp. 19–21), and we concur with the study results. Therefore, the acuña cactus and the needle-spine cactus are valid and distinct taxa separated morphologically and geographically. Baker (2007, p. 20) recommended nomenclatural changes, based on the International Rules of Botanical nomenclature, but formal name changes were not proposed in his study. Again, we refer to the taxonomy determined by the Flora of North America.

Habitat

The acuña cactus occurs in valleys and on small knolls and gravel ridges of up to 30 percent slope in the Palo-Verde-Saguaro Association of the Arizona Upland subdivision of the Sonoran Desert scrub at 365 to 1,150 m (1,198 to 3,773 ft) in elevation (Phillips *et al.* 1982, p. 4; Arizona Rare Plant Guide Committee 2001, unpaginated; AGFD 2011, entire). This species grows on soil overlying various bedrock types including extrusive felsic volcanic rocks of rhyolite, andesite, and tuff, and intrusive igneous rocks composed of granite, granodiorite, diorite, and Cornelia quartz monzonite; Locomotive fanglomerate (sedimentary rock consisting of heterogeneous fragments of all sizes deposited in an alluvial fan and later consolidated) is also locally present (Rutman 2007, pp. 1–2; Anderson 2012a, pers. comm.). Mineralogy of these rocks is varied, with felsic or mafic phenocrysts present, depending on bedrock type (Rutman 2007, pp. 1–2; Anderson 2012a, pers. comm.). Soil texture in these locations varies between bedrock and both coarse- and fine-textured substrates (Rutman 2007, pp. 1–2). Associated plant species include *Larrea tridentata* var. *tridentata* (creosote bush), *Olneya tesota* (ironwood), *Cercidium microphyllum* (palo verde), *Ambrosia deltoidea* (triangle-leaf bursage), and *Acacia greggii* (catclaw). The acuña cactus is often noted growing under the protective canopy of these or other associated species (Phillips *et al.* 1982, p. 6; Butterwick 1982–1992, entire; Felger 2000, p. 208; Service 2011a, p. 1; Service 2011b, p. 3), which may act as nurse plants, thereby sheltering seedlings from extreme temperatures and providing some protection from mechanical disturbance (Nobel 1984, p. 316; Suzán *et al.* 1996, p. 635).

Distribution and Range

The acuña cactus populations are known from Maricopa, Pima, and Pinal Counties in Arizona and from Sonora, Mexico (AGFD 2004, p. 2). In western Pima County, plants are known from the Puerto Blanco Mountains and adjacent Aguajita Wash and in the foothills of the Growler Mountains south of Dripping Spring on National Park Service (NPS) lands within OPCNM; from the Sauceda Mountains on Bureau of Land Management (BLM) lands; from Department of Defense military lands on the Barry M. Goldwater Gunnery Range (BMGR); and from private lands near Ajo. There is an unconfirmed report of acuña cactus individuals occurring on Tohono O'odham lands in the vicinity of known populations on BLM and BMGR lands; however this has not been verified (Howe 2012, pers. comm.). In Maricopa County, the acuña cactus is known from the Sand Tank Mountains on BLM lands within the Sonoran Desert National Monument. In Pinal County, plants are known from Mineral Mountain on BLM, State, and private lands. In Sonora, Mexico, the acuña cactus occurs on Reserva de la Biosfera El Pinacate y Gran Desierto de Altar (Pinacate Biosphere Reserve) and private ejido (ranch) lands. Available information indicates that the current range of this species does not differ from the historical range, with the exception that the current Ajo populations likely had been part of a larger population that

occurred before mining activity began there (Rutman 1996b, pers. comm.; Rutman 2007, p. 7). However, there are no survey records for this species in the area prior to mining activity.

Abundance and Trends

As the number of dead individuals documented within acuña cactus populations has increased greatly since study began in the 1970s (when tracking first began), it is important to track the number of healthy, unhealthy, and dead individuals. This not only allows us to document trends in total plant numbers, but can help in our understanding of the cause and extent of mortality.

Federal Land—Organ Pipe Cactus National Monument (OPCNM)

There is one large area of approximately 1,326 ha (3,277 ac) within OPCNM that contains as many as 2,000 acuña cactus individuals (Rutman 2011, pers. comm.; AGFD 2011, entire). In 1981, this population was estimated to contain 10,000 individuals (Buskirk 1981, p. 3). Within this area, two 20-by 50-m (66-by 164-ft) permanent monitoring plots were established in 1977, with the aim of investigating growth, mortality, and recruitment of this species. Between 1977 and 1981, there was 31 percent mortality in the plots (Phillips and Buskirk 1982, p. 2). Two more plots were added in 1983, and two more in 1988. From 1988 through 1991, the population was thought to be stable or increasing (Johnson *et al.* 1993, p. 172). From 1993 through 2011, annual mortality was variable, but exceeded recruitment in most years (NPS 2011a, p. 2). In 2011, the total number of individuals recorded in all six plots was 39 adults and 10 juveniles, showing little change since 2010. This however represents a marked decrease since their peak in 1991, when 446 individuals were recorded in the plots, 221 of which were juveniles (Holm 2006, p. 9; NPS 2011a, entire).

In order to verify the identification and location of plants, specimens are collected, pressed, and placed on sheets that are stored in herbaria. A 1952 herbarium collection from a second location within OPCNM is evidence that a second disjunct population of the acuña cactus occurred historically within OPCNM. Current NPS staff were unaware of this herbarium collection, and the site, reported to be within 3 m (10 ft) of the U.S.-Mexico border, has not been revisited since 1952. Site visits in this area are currently considered dangerous, and therefore no efforts have been made to confirm the location of the population; we do not know if the population exists at this location.

Federal Land—Bureau of Land Management

Sauceda Mountains—Within the Coffeepot Area of Critical Environmental Concern (ACEC), there are several small acuña cactus populations, each on less than 2 ha (5 ac) of land.

In 1982, the BLM (Phoenix District) established three 20-by 50-m (66-by 164-ft) monitoring plots on Coffeepot Mountain. These plots were visited, and data were collected periodically between 1982 and 1992. In 1982, 157 living and 3 dead plants were found within plots. Over the years of study, many new recruits were found; however, there was also ongoing mortality with newly dead individuals documented each year. A census of individuals from both within and nearby the plots in 1987 found 310 living and 332 dead plants (Rutman *et al.* 1987, p. 2). BLM staff reported a precipitous decline of this population in 1989 (Johnson 1989, p. 1). By the last monitoring visit to the plots in 1992, 150 plants were recorded dead, 22 plants were recorded missing and presumed dead, and 150 plants remained that were either healthy or in some stage of decline (Butterwick 1982–1992, entire). A note to the files in 1991 stated that many individual plants were missing, dead, or dying, and that there appeared to be little regeneration in this population (BLM 1991, p. 1). The plots have not been formally measured since 1992, but the BLM has visited this site 21 times since then to assess general health and threats to the population. Field notes by the BLM botanist in 2007 mentioned that the number of living individuals in and near these plots had been reduced by half since the 2006 site visit (Anderson 2011, p. 2). Because no population estimates were made during either year, it is difficult to know how many plants survive in and around these plots. Field notes do indicate that few juveniles were seen in 2008, and no juveniles were seen in 2009; no mention of juveniles was made in 2010 or 2011 (Anderson 2011, p. 2).

In 2006, a second population, estimated to be between 50 and 100 individuals, was located 1.2 kilometers (km) (0.75 miles (mi)) northwest of the Coffeepot Mountain monitoring plots in Ryans Canyon (Rutman 2006, p. 2). Rutman (2006, entire) did not mention size class or health of this population. This site has not been revisited.

A third population was discovered in 2006, 1.4 km (0.87 mi) to the northeast of the Coffeepot Mountain monitoring plots. Approximately 30 acuña cacti were noted there at the time; 25 percent mortality was reported one year later (Anderson 2011, p. 1). An October 2011 site visit by Service and BLM botanists revealed 23 adult and 2 juvenile living and 15 dead plants at this location (Service 2011a, p. 3). A fourth population was discovered by the BLM in March 2011, in a location near the third population; 10 plants were noted. No indications were given as to the age class structure or health of this population (Anderson 2011, entire).

At a site BLM calls Little Ajo Mountains, southeast of the New Cornelia Mine on less than 0.4 ha (1 ac), the population has fluctuated from 5 plants in 1997, to 7 plants in 2001, to 7 plants in 2006, to 11 plants in 2007, to 7 plants in 2008, and finally to 12 plants (including 5 very small plants) in 2011 (Rutman 2006, p. 2; Anderson 2011, entire; Service 2011a, p. 1).

Sonoran Desert National Monument—In 2006, approximately 200 individuals were reported from the Sand Tank Mountains in an area less than 25 ha (61.8 ac) in size. In 2007, the site was revisited, and four groups of individuals accounting for 125 of the approximately 200 individuals were mapped (Anderson 2012b, pers. comm.; Anderson 2011, p. 2). No indications were given as to the age class, structure, or health of this population (Anderson 2011, entire).

Mineral Mountain—There are 3 individual acuña cacti growing on BLM land adjacent to 30 living plants and 22 dead plants on State lands. This population is discussed collectively below under State lands.

Federal Land—Barry M. Goldwater Gunnery Range

In 1997, a single adult individual was reported from just north and outside of the populations in the Coffeepot ACEC (Geraghty *et al.* 1997, p. 5) within Department of Defense (DOD) managed lands on the Barry M. Goldwater Gunnery Range (BMGR); this site has not been revisited.

State Land

Mineral Mountain—Plants were collected by Hart in 1992, from the population straddling BLM and State land east of Florence (University of Arizona Herbarium 2011, entire). There were no details of the number of individuals seen, just a map with three locations. In the 1990s, the BLM revisited this site and estimated 100 individuals scattered across 3 ridgelines (Service 2008a, p. 1). In 2008, the Service and BLM searched this area. The Service and BLM found fewer than 20 living and many dead plants; no young plants were seen. In 2011, the

Service and BLM botanists revisited the location and found 30 living and 22 dead plants scattered across 4 adjacent ridgelines on less than 5 ha (12.4 ac) of land; no juveniles were found (Service 2011b, p. 1).

Ninety-Six Hills—This population is in the vicinity of Florence on less than 1 ha (2.47 ac) of land. Parfit (1977, p. 1) noted that plants here were common, but very localized. Many plants of various ages and sizes were noted, as well as many dead plants. Engard (1977, p. 1) noted many seedlings and mature plants and also that the plants were abundant locally. Rutman and Krausman (1988, p. 1) found 29 live plants and 6 dead plants in a 2-hour survey in the same general area. Breslin (2008, pp. 3–5) reported that in over 60 hours of survey effort in the area he had located 45 plants, 1 seedling, and 17 dead plants. On March 20, 2008, the Service plant ecologist found 11 live plants and 10 dead plants in a 3-hour survey. In the same general area, C. Butterworth (2008, pers. comm.) found 32 live plants, of various sizes, except seedlings. He noted that seedlings were very noticeably absent. A 2011 2-hour survey by three Service and BLM botanists revealed no living and two dead adults in this same general area (Service 2011b, p. 3). Because this population was not mapped with Geographic Information Systems, it is impossible to know if survey efforts in 1977, 1988, 2008, and 2011 were all conducted in the exact same location within this general area. Therefore, it is not possible to conclude that this population has been extirpated.

Private Land

Ajo Area—The combined area of these multiple sites is less than 0.4 ha (1 ac) (Rutman 2007, p. 1).

An isolated population near Darby Wells was first reported by Heil and Melton (1994, p. 14). Fewer than 10 plants were found at this site in 2007 (Rutman 2007, p. 4). There is no record if juveniles were among the plants found. The site has not been revisited.

On Indian Village Hill, there were 102 plants in 1996, when the population was first recorded (Rutman 1996b, pers. comm.). In 2006, 30 living and 33 dead plants were found; in 2007, a quick census noted fewer than 40 plants found (Rutman 2006, p. 1; Rutman 2007, p. 4). There is no record if juveniles were among the plants found in either year. In 2011, eight living and seven dead plants were recorded; no juveniles were found (Service 2011a, p. 1).

There were 16 live and 19 dead plants on Weather Tower Hill in 2006 (Rutman 2006, p. 1). There is no record if juveniles were among the plants found. The site has not been revisited.

Florence Area—Roadside populations occur on less than 0.4 ha (1 ac) collectively; any additional populations that may be present on private land occur on an unknown quantity of land.

Roadside Population One—The 2011 site visit revealed 9 living and 2 dead individuals; no juveniles were found, though all 9 were young healthy individuals (Service 2011b, p. 2)

Roadside Population Two—The 2011 site visit revealed 2 living and 2 dead individuals; no juveniles were found (Service 2011b, p. 2)

There may be other locations on private lands unknown to Service or BLM botanists.

Sonora, Mexico

Felger (2000, p. 208) noted the occurrence of the acuña cactus between 3 and 18 km (2 and 11 mi) southwest of Sonoyta; no population estimates were made. Surveys of 7 groups of plants in this area from 2009 through 2010 revealed 659 living and 942 dead plants growing on approximately 1,700 ha (4,200 ac) (Pate 2011, pers. comm.; Pate 2011, map 1 and map 2). Pate (2012a, pers. comm.) noted seeing a few small seedlings among these plants.

Summary

Presented below is the total estimate of living, dead, and juvenile acuña cactus plants in populations visited over multiple years, including census results from 2011 and from previous years if sites have not been revisited or population estimates not updated. Notable trends are the large amount of mortality within the populations that have been visited more than once and the low numbers of juvenile plants in the populations.

- NPS—2,000 plants, or 58.9 percent of known individuals; estimated in 2011 by NPS staff. This population estimate is down from 10,000 individuals estimated at this location in 1981. Within the OPCNM plots, the number of recorded individuals peaked in 1991, with 446 plants found. In 2011, 49 total individuals including 10 juveniles were noted within these plots.
- Sonora, Mexico—659 plants or 19.4 percent of known individuals; estimated from 2009 to 2010 surveys. Nine hundred and forty-two dead individuals were also recorded during this survey period. There are no previous estimates from this population. A few juvenile plants were noted during the 2009 to 2010 survey period.
- BLM—655 plants, or 19.3 percent of known individuals; estimated from 2011 and other recent surveys. At Coffeepot mountain within the largest BLM population, 310 living and 332 dead individuals were recorded in 1987. This population was reduced to 150 individuals by 1992, and was reduced to approximately 75 individuals by 2006. No juveniles were noted since 2008, when a few were seen.
- Private Land—48 plants (37 near Ajo and 11 near Florence), or 1.4 percent of known individuals; estimated from 2011 and other recent surveys. A single population that was revisited on several occasions showed a total population of 102 individuals in 1996; in 2006, 30 living and 33 dead plants were found. In 2011, just 8 adult plants and no juveniles were recorded from this population.
- State Land—32 plants, or 0.9 percent of known individuals; estimated from 2011 surveys. At one location in the 1990s, the population was estimated to be 100 individuals; in 2008, only 20 living and many dead plants were found with no juveniles seen. In 2011, 30 living plants were recorded, including a new subpopulation previously not recorded. No juvenile plants were located in 2011. At a second location, in 1977, plants were considered common but localized, and the site supported many plants of various ages and sizes. Surveys of this area in 2008 resulted in the location of 45 adult plants with no juveniles found. In 2011, no living plants and two carcasses were located in this same area.
- Military BMGR—1 plant, or less than 0.1 percent of known individuals in 1997; the site has not been revisited.

Summary of Factors Affecting the Acuña Cactus

Section 4 of the Act (16 U.S.C. 1533), and its implementing regulations at 50 CFR part 424, set forth the procedures for adding species to the Federal Lists of Endangered and Threatened Wildlife and Plants. Under section 4(a)(1) of the Act, we may list a species based on any of the following five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; and (E) other natural or manmade factors affecting its continued existence. Listing actions may be warranted based on any of the above threat factors, singly or in combination. Each of these factors is discussed below.

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

Based on the habitat characteristics described above, potential factors that may affect the habitat or range of the acuña cactus are: (1) Urban development and site degradation; (2) livestock grazing; (3) border activities; (4) nonnative, invasive plant species; (5) mining; and (6) drought and climate change.

Urban Development and Site Degradation

The immediate threats from urban development include the direct loss of individuals and habitat. Indirect impacts of urban development include fragmentation of acuña cactus and associated pollinator populations, which can reduce genetic vigor of the cactus and result in degradation and fragmentation of habitat adjacent to development. When development occurs, there is also an increased use of habitat for recreational activity, which may also deplete habitat and result in mortality of individuals. The acuña cactus populations in OPCNM and the Sonoran Desert National Monument are protected from the immediate threats associated with urban development due to their National Monument status. National Monuments are lands set aside and managed to protect the natural and cultural resources within; development is minimal, though some site degradation may still occur.

To meet the country's energy demands, there has been a recent emphasis by the Federal Government to use BLM lands for development of renewable energy. Currently, there are no planned solar or wind energy projects on or near populations of the acuña cactus in the Sauceda, Sand Tank, or Mineral Mountains (Werner 2011, pers. comm.). In addition, most populations on BLM lands are remotely located and relatively inaccessible; therefore, we do not anticipate development in these areas.

As Arizona's population is expected to continue to grow in the future, both Pinal County and the State Land Department are promoting urban development in the vicinity of Florence (Pinal County 2009, pp. 4, 60, 94; Guthrie *et al.* 2011, p. 1). When the housing market rebounds, it is likely that additional State lands in this area will be sold for urban development (Pinal County 2009, p. 42; Guthrie *et al.* 2011, p. 2). In the vicinity of Florence, there are no current plans for development of State lands known to support acuña cacti. Private lands near Florence containing acuña cacti populations have been for sale as subdivided 16.2-ha (40-ac) parcels for many years. With the recent economic downturn, it is unlikely this land will be sold in the near future. The only known private land populations where access is readily available are at 3 sites near Ajo, totaling less than 0.4 ha (1 ac) and supporting fewer than 40 individuals in total (Rutman 2006, p. 1; Rutman 2007, pp. 1, 4; Service 2011a, p. 1). In most of the privately owned locations, the sites are littered with broken glass, bottles, and trash; however, plants appear little impacted by this habitat degradation (Service 2011a, p. 1; Service 2011b, p. 2).

Indirect urbanization effects to the areas that support the acuña cactus include ORV activity, which has been reported on BLM lands near both Ajo and Florence. These reports, however, showed no impact on the acuña cactus populations in 1994 (Heil and Melton 1994, pp. 15–16), although habitat degradation and direct loss of individuals is possible from this activity. In 1988, the BLM closed the Coffeepot ACEC to recreational ORV use (BLM 2011, p. 194) and, in 1990, prohibited ORV use outside of designated trails within the Sonoran Desert National Monument (BLM 2011, p. 181). In 2011, the BLM Lower Sonoran Field Office released a Draft Resource Management Plan and Environmental Impact Statement (Draft RMP/EIS) for review (BLM 2011, entire). This document supports the continued prohibition of ORVs outside of designated trails within the Sonoran Desert National Monument (BLM 2011, p. 181). Within the Coffeepot ACEC, alternatives for motorized travel range from no use to limited use on existing routes, but all alternatives restrict travel off of existing routes, thereby reducing the potential for impacts to the acuña cactus (BLM 2011, pp. 181, 185–188). Once finalized, the new RMP/EIS for the Lower Sonoran and the Sonoran Desert National Monument will remain in effect for the next 15 to 20 years (Foreman 2011, pers. comm.). The impacts of ORV activity on State or private lands are unknown; for ORV activity within the border region, see the discussion below of border activities.

In Sonora, Mexico, scattered populations of the acuña cactus occur within 10 km (6.2 mi) of the town of Sonoyta. Although the area is reported to be little-used and unoccupied except by drug and human smugglers (Pate 2011, pers. comm.), in recent decades and as a result of human demand, the Sonoyta region has been heavily impacted by *Olneya tesota* (ironwood) and *Prosopis velutina* (mesquite) woodcutting for coal production, brick foundries, and tourist crafts, and the lands' subsequent conversion to exotic grasslands for cattle grazing (Suzán *et al.* 1997, pp. 950, 955). This activity has affected more than 193,000 ha (478,000 ac) of lands in the Sonoyta region (Nabhan and Suzán 1994, p. 64). In a study of ironwood extraction in northern Mexico, the Sonoyta study sites exhibited the highest number of damaged and dead trees, and had the lowest associated plant diversity (Suzán *et al.* 1996, p. 642). It is likely that habitat parameters for the acuña cactus populations in Sonora are impacted by this activity, particularly because ironwood is considered a dominant associate of the acuña cactus (Phillips *et al.* 1982, p. 5) and may serve as a nurse plant for a variety of cacti (Suzán *et al.* 1996, p. 635).

In addition, the actions of harvesting, burning, loading, and transporting wood and charcoal can result in running over individual acuña cactus and causing injury or mortality of plants, if such actions occur in areas supporting the acuña cactus. Also, human population growth and development in the border region between the United States and Mexico has risen in recent decades (Brown and Caldwell 2008, pp. 1–6); it is reasonable to conclude that the direct and indirect effects of urbanization are likely to increase threats to the acuña cactus populations in this region. The populations are currently split by a major highway, Interstate 8, and a power transmission line; many plants occur within 200 m (660 ft) of these corridors (Pate 2011, map 1 and map 2).

In summary, the direct and indirect effects of urbanization are threats to a portion of the known populations of the acuña cactus. However, these effects are currently limited to the acuña cactus populations in the vicinity of Ajo and Florence in the United States and in the immediate border region of Sonora, Mexico. These areas collectively make up less than 21 percent of known living acuña cactus individuals across the range of the acuña cactus. The majority of the range in the United States is protected from urban development because populations are on Federal lands, where little or no development will take place. In addition, most populations of the acuña cactus are relatively remote or otherwise protected from the effects of urbanization. We conclude that urban development and site degradation is not currently a threat to any entire population of the acuña cactus. As a result, based on our review of the available information, we conclude that the direct and indirect

effects associated with urbanization are not threats to the acuña cactus and its habitat.

Livestock Grazing

In general, grazing practices can change vegetation composition and abundance and cause soil erosion and compaction, reduced water infiltration rates, and increased runoff (Klemmedson 1956, p. 137; Ellison 1960, p. 24; Arndt 1966, p. 170; Gifford and Hawkins 1978, p. 305; Waser and Price 1981, p. 407; Robinson and Bolen 1989, p. 186; Holechek *et al.* 1998, pp. 191–195, 216; and Loftin *et al.* 2000, pp. 57–58). These anticipated effects leave less water available for plant production (Dadkhah and Gifford 1980, p. 979). In addition, livestock can step on or knock over individual acuña cactus. Although other species of cacti may be good survival forage for livestock (Vega-Villasante *et al.* 2002, p. 499), herbivory of the acuña cactus has not been reported. Livestock grazing levels and habitat condition vary greatly between populations due to varied land ownership and management. A discussion of populations arranged by land management agency follows.

National Park Service—Beginning in the early 1900s and continuing through the 1970s, lands within OPCNM were grazed heavily, with as many as 3,000 head of cattle and hundreds of burros present at a time when carrying capacity was estimated to be 314 cattle per year (Rutman 1997, p. 364; NPS 2011b, entire). Grazing by domestic animals was halted per NPS policy and has not occurred within OPCNM since 1976 (NPS 1997, p. 33). Lands here continue to recover slowly after loss of soils and vegetation and may take many decades or centuries to recover fully (NPS 2001, pp. 27, 124). Currently, OPCNM supports the largest population of the acuña cactus (59 percent of known living acuña cactus individuals), and we are not aware of historical effects to the population as a result of past livestock grazing.

Bureau of Land Management—All four populations of the acuña cactus on BLM lands in the Sauceda Mountains have been managed since 1988 in the Coffeepot ACEC, which attempts to apply grazing management practices to ensure perpetuation of botanical diversity within the area and prohibits the development of livestock facilities that would serve to increase livestock use within the area (BLM 2011, p. 141). Collectively these four populations make up 13.1 percent of known living acuña cactus individuals. In 1987, when speaking of the then proposed Coffeepot ACEC, Olwell (1987, p. 1) noted relatively pristine conditions with no immediate threat to the acuña cactus plants. At that time, however, the population of acuña cactus within the Coffeepot ACEC in the vicinity of permanent monitoring plots was reported to have substantial animal activity from cattle, javelina, and jackrabbits, with browsing, grazing, and soil disturbance noted (Rutman *et al.* 1987, p. 2). Anderson (2011, entire) noted no habitat impacts from grazing in this population during yearly visits from 1994–2011. This population is the farthest population from a single cattle tank (see below) within the ACEC, and therefore is less subjected to livestock pressure.

In 1970, a cattle tank named Conley Reservoir was established within the Coffeepot ACEC boundary prior to the ACEC designation and remains today (Foreman 2012, pers. comm.). A population of acuña cactus very near this tank was visited by the BLM botanist in 2010, who found abundant prickly pear (*Opuntia* spp.), which are known to increase with disturbance and are often cited as an indicator of poor range condition (Anderson 2011, p. 2; Johnson 2000, entire). A site visit in 2011 by Service and BLM botanists found habitat impacts such as soil disturbance from both cattle and feral burros; however, no acuña cactus plants appeared to be directly impacted by these animals (Service 2011a, p. 3). Feral burros also impact vegetation on neighboring military lands (see *Department of Defense* section below).

The new BLM Draft RMP/EIS has implications for future livestock management within the Coffeepot ACEC and the Sonoran Desert National Monument (BLM 2011, entire). According to this document, under Alternative A (the no action alternative), livestock grazing within the ACEC would not change from the current regimes with no livestock facility development permitted (BLM 2011, pp. 32, 141). Under Alternative B, livestock grazing only in times of suitable forage production (ephemeral) would continue to be considered, but perennial stocking rates would be reduced by approximately 40 percent, and no livestock facilities would be developed that would increase livestock use within the area (BLM 2011, pp. 33, 196). Under Alternative C, grazing allotments designated as perennial/ephemeral would be reclassified as perennial only, with no supplemental ephemeral grazing applications considered (BLM 2011, p. 34). Under Alternative D, all allotments currently open to grazing would become unavailable as permits expire (BLM 2011, p. 35). Under Alternative E, the BLM's preferred alternative, current grazing levels and timing would remain the same, but livestock facilities could be developed with the aim of improving natural resource conditions through greater distribution of livestock (BLM 2011, p. 171). It is unclear if additional tanks would, as is implied, relieve pressure on the acuña cactus populations; it is also unclear if this would increase the overall number of cattle (or burros) in the area or the amount of land impacted, thus potentially impacting more acuña cactus populations. Whichever alternative is ultimately chosen, the finalized version of this management plan will remain in effect for 15 to 20 years after signing later in 2012 (Foreman 2011, pers. comm.).

In 2001, Presidential Proclamation 7397 (Clinton 2001, entire) created the Sonoran Desert National Monument; one population of acuña cactus containing 5.9 percent of known living acuña cacti occur in the Sand Tank Mountains. This area was designated for military purposes in 1941, and has had no livestock grazing for over 60 years (Clinton 2001, p. 2). During a site visit in 2006, no habitat impacts from livestock were reported from this location (Anderson 2011, p. 2). The current livestock management regime of no livestock being permitted within the Sonoran Desert National Monument Sand Tank Mountains acuña cactus population will be maintained for at least the next 15 to 20 years (BLM 2011, pp. 36–40; Foreman 2011, pers. comm.).

Department of Defense—A single acuña cactus plant was found on BMGR approximately 1 km (0.62 m) to the north of a known population within the BLM Coffeepot ACEC (Geraghty *et al.* 1997, p. 5). Livestock grazing is not authorized on the BMGR, though some trespass cattle do occur (Whittle 2012, pers. comm.). Feral burros on BMGR are a concern, however, and BMGR managers plan to implement a burro trapping program in the spring of 2012, in an attempt to reduce damage to vegetation (Whittle 2012, pers. comm.).

Arizona State Trust Lands (State land)—Populations of acuña cactus on State land in the Mineral Mountains are subject to grazing; two land sections containing this species are collectively part of a larger 6,118-ha (15,118-ac) grazing lease with a total carrying capacity of 118 animal units (Sommers 2012, pers. comm.). Three individual acuña cacti from this group of populations overlap onto adjacent BLM land. This BLM land, which is not fenced from adjacent State land, has a total permitted number of cattle of 357 year long, though the lessee did not run

the full amount of animals in 2011 (Tersey 2012, pers. comm.). During a 2011 site visit, the habitat appeared unaltered by livestock, and no cattle were seen (Service 2011b, p. 1).

Three additional land sections near Box O Wash containing this species are collectively part of a lease of 12,369 ha (30,565 ac) with a total carrying capacity of 236 animal units (Sommers 2012, pers. comm.). Both leases incorporate State and BLM lands, although in this area the species has been found on State lands and not the associated BLM lands. No livestock were seen during the November 2011 site visit to this population (Service 2011b, p. 3). Only two dead individual acuña cacti were found, and neither appeared to have been knocked over by cattle (Service 2011b, p. 3). In the past, Rutman and Krausman (1988, p. 1) recommended that this State land habitat could benefit from improved livestock management, as cattle trails there were numerous during a 1988 site visit. In a 2008 site visit, it was noted that quite a few of the dead acuña cactus plants may have been knocked over by livestock (Service 2008b, p. 1). It is unknown what the grazing lease or animal units were for this period of time. In 2011, several individuals were noted to have grown additional arms following the loss of the growing tip (Service 2011b, pp. 3–4). This was possibly due to mechanical damage caused by cattle, a beneficial adaptation to disturbance noted previously by Phillips *et al.* (1982, p. 6). The populations on State land represent just 0.9 percent of known living acuña cactus individuals. Although livestock grazing on State lands may benefit from improved management, the impacts to the acuña cacti are small.

Private—Populations of the acuña cactus on private lands near the town of Ajo were noted to occur in degraded habitat with low species richness; these sites were suspected to have had a grazing history of severe use (Rutman 1995, p. 1). Those acuña cacti on private lands near Florence are in an unknown condition, as they are not typically visited by Service staff. Two roadside populations visited in 2011 had four dead plants and 13 healthy plants collectively; all dead plants seemed to have died from drought or insect attack, although one population did contain evidence (feces) of cattle use (Service 2011b, p. 2). Private lands account for just 1.4 percent of known living acuña cactus individuals.

Mexico—In Mexico, researchers report livestock grazing in parts of the Sonora range (Stoleson *et al.* 2005, p. 60), but mostly the habitat remains little-used and unoccupied land (Pate 2011, pers. comm.). Sonora maintains 19.4 percent of the known acuña cactus individuals across the range; their recent decline, as evidenced by nearly 1,000 dead plants counted in 2010, has not been attributed to livestock.

In summary, 64.9 percent of acuña cactus individuals occur within lands protected from cattle grazing either by NPS or BLM National Monument status. In areas occupied by the acuña cactus where livestock grazing does occur, impacts from livestock do not appear to be a consistent or significant threat to populations. Based on our review of the available information, we conclude that, although there is evidence that grazing impacts to the acuña cactus do occur, we do not believe that these effects occur to such an extent that livestock grazing is a threat to the acuña cactus and its habitat.

Border Activities

Over the past decade or more, tens of thousands of people illegally attempt crossings of the U.S.-Mexico border into Arizona annually (cross-border violators) (Service 2011c, p. 14). As a result of increased U.S. Customs and Border Protection (CBP) in the Douglas, Arizona, area, and in San Diego and southeastern California, cross-border violator traffic has shifted into remote desert areas such as OPCNM (Service 2011c, p. 14). For example, in 2001, an estimated 150,000 people entered OPCNM illegally from Mexico (Service 2011c, p. 14). With the increase in technology, border fencing, and manpower between 2001 and 2012, these numbers are down considerably, with 6,218 arrests of cross-border violators from OPCNM in the year 2011 (Oliver 2012, pers. comm.). Although the number of arrests does not represent all those who attempted to enter OPCNM illegally, this number is suspected to be considerably less than reported in 2001. Despite the fact that these numbers are down due to enforcement and deterrence efforts by the CBP, the thousands of people crossing through the border area illegally still represent a substantial impact to the resource.

More than 78 percent of the known living acuña cactus individuals occur within 16.5 km (10.25 mi) of the border in either OPCNM or Sonora, Mexico. Cross-border violators, CBP, and NPS Law Enforcement (LE) activity in this area may degrade acuña cactus habitat by creating new roads and trails, disturbing vegetation and soils, and moving exotic plant seeds or plant parts, leading to their spread into unoccupied areas (Duncan *et al.* 2010, p. 124). At OPCNM, the acuña cactus occurs in an area that is closed to visitors due to dangers of drug and human smuggling; in addition, for many years, OPCNM natural resource staff have not been allowed to access the area without LE personnel accompanying them. Significant impacts may occur when travel moves off existing roads causing vegetation destruction, soil compaction (Duncan *et al.* 2010 p. 125), and, potentially, direct mortality of the acuña cactus by running over individuals, although no direct impacts to acuña cactus have been observed. Staff at OPCNM note that roughly 2 years ago, two vehicle tracks and associated articles of clothing from cross-border violators were found within one of the six 20 by 50 m (66 by 164 ft) acuña cactus long-term monitoring plots (Holm 2012a, pers. comm.). Although no individual plants were reported to have been run over in this instance, the occurrence of the activity within this proximity to acuña cactus individuals supports our conclusion that impacts from cross-border violators and border enforcement may negatively impact the species and could be a threat.

In 2006, a vehicle border fence was completed in OPCNM. This fence has significantly reduced vehicular traffic from illegal entrants. The Biological Opinion for the Ajo Forward Operating Base Expansion reported personal observations by NPS and Service employees that the number of off-road tracks and new roads continues to increase (Service 2011c, p. 19). These new off-road tracks and roads are believed to be the result of CBP response by vehicle, horseback, and foot to cross-border violators, who are travelling primarily on foot (Service 2011c, p. 19). By 2011, OPCNM personnel had mapped thousands of miles of unauthorized off-road impacts from cross-border violators, CBP, and LE activities (Service 2011c, p. 18). Staff at OPCNM has been compiling data on off-road traffic and mapping unauthorized roads on OPCNM for a report. Prior to finalizing the determination on listing the acuña cactus, this report will have been completed and will be considered in the final determination. Although most of the unauthorized roads were created prior to construction of vehicle and pedestrian fences along the U.S.—Mexico international border, it is not known if the additional roads were created after the construction of the border fences. In 2011, NPS staff noted no new heavily utilized routes due to off-road travel by vehicles, but staff did state that single vehicles drive across habitat, and individual acuña cactus plants may be driven over. There is no

evidence that acuña cacti have been harmed, but damage to larger plants has been documented due to similar activity (Rutman 2011, pers. comm.). In cooperation with Service staff, CBP has begun efforts to educate Border Patrol agents on the locations and appearance of acuña cactus so that the areas that support the plant can be avoided to the maximum extent possible. Designated critical habitat in OPCNM will be marked on road atlases being prepared by OPCNM staff and provided to the agents patrolling in the OPCNM area.

A system of sensors and communication towers is currently in place and is being expanded within the border region; this technology improves deterrence, detection, and apprehension of cross-border violators entering or attempting to enter the United States illegally (Service 2009, p. 5). It is expected that with increased communication and sensor tower technology, there will be a reduction in the need for CBP agents to patrol the area, thus reducing circumstances requiring vehicles to drive off of authorized roads (Service 2009, p. 16). CBP agents on foot or on horseback may conduct off-road pursuit of suspected cross-border violators at any time, including in areas designated or recommended as wilderness (Service 2009, p. 17). However, where there are exigent or emergency circumstances, CBP agents may conduct motorized off-road pursuit of cross-border violators, including in areas designated or recommended as wilderness. Where such motorized pursuits are necessary, CBP has committed to using the least intrusive or least damaging vehicle readily available, without compromising officer or agency safety.

There are no existing or proposed communication towers near any acuña cactus populations within OPCNM; however, human traffic patterns have changed since the installation of towers in and near OPCNM. This change of pattern has created a larger impact footprint due to traffic moving farther from towers. In addition, communication and sensor towers and associated tactical infrastructure require maintenance and repair. Species proposed for listing, such as the acuña cactus, could be directly affected by repair and maintenance of this infrastructure if maintenance vehicles traveled off of approved access routes. However, CBP has committed to use only approved access routes for these maintenance activities. Therefore, these effects would be negligible for acuña cactus. In addition, if these maintenance and repair activities occur in undisturbed areas in the habitat of listed plant species, a survey must be conducted and a sufficient buffer created to protect any plants found (HDR 2012, pp. 4–3).

Illegal drug and human smuggling also adversely affects the area of the Coffeepot ACEC, but the area is less impacted than other border areas (BLM 2011, p. 344). This is likely the case with the other populations on private and BLM lands near Ajo and Florence. Within BMGR, cross-border violators and associated activities represent a significant threat to natural and cultural resources within the BMGR, including having widespread and adverse effects on soil and hydrology (U.S. Departments of the Air Force and Navy 2007, pp. 3–11). We are aware of no instances of illegal activity or law enforcement activity impacting the populations near Florence. The Service (2008b, p. 1) noted that little to no human activity, including ORV use, was observed during a 2008 site visit to these populations.

The acuña cactus populations across the border from OPCNM, in Mexico, occur on land that is little-used, unoccupied, and subject to heavy traffic by drug and human smugglers (Pate 2011, pers. comm.). This area was reported to be not very safe, and warnings were given to Service personnel not to travel to this location alone (Larios 2011, pers. comm.). In 1993, the Mexican government established Pinacate Biosphere Reserve, a 7.7-million ha (1.9-million-ac) reserve for the region's flora, fauna, geology, and archeology preservation. A portion of the acuña cactus individuals in Sonora occur within the Pinacate Biosphere Reserve. It is unknown what, if any, protection this designation provides the acuña cactus.

In summary, the two areas containing the largest number of living acuña cactus (78 percent of the known living acuña cactus individuals) occur along the U.S.-Mexico border (in OPCNM and Sonora, Mexico). Within populations, acuña cacti are typically spaced within 3 m (9.8 ft) of each other, and thus vehicle traffic through any population could potentially impact many individuals. This area is heavily impacted by cross-border violators, CBP, and LE activity, as evidenced by the tremendous increase in illegal roads and trails documented by agencies along the border. To date, no individual acuña cactus plants are reported to have been lost to these activities; however reporting from this area is inconsistent. With anticipated continued border activity in the area, it remains possible that acuña cactus individuals and their habitat will be impacted. These impacts include: creation of new roads and trails; disturbance of associated vegetation including nurse plants and microclimates; compaction or erosion of soils; movement of nonnative, invasive plant seeds and plant parts; and the potential to cause direct mortality to individuals by running over plants with vehicles. Therefore, based on our review of the available information, we conclude that cross-border violators, CBP, and LE off-road activities are a threat to the acuña cactus and its habitat.

Nonnative, Invasive Plant Species

Throughout the Sonoran Desert ecosystem, invasions of the introduced *Pennisetum ciliare* (buffelgrass), *Bromus rubens* (red brome), *Eragrostis lehmanniana* (Lehmann lovegrass), *Schismus barbatus* (Mediterranean grass), and *Pennisetum setaceum* (crimson fountaingrass) have altered nutrient regimes; species composition and structure; and fire frequency, duration, intensity, and magnitude (Brooks and Pyke 2001, p. 5). Although most of these species were intentionally introduced as forage for livestock, as erosion control, or as ornamentals, each is now considered invasive and a threat to this ecosystem (Búrquez-Montijo *et al.* 2002, entire). Species such as buffelgrass are expected to increase their range even with continued and predicted drought events (Ward *et al.* 2006, p. 724). It is generally thought that invasion by exotic annual grasses will continue unchecked in the Sonoran Desert ecosystem in the future, reducing native biodiversity through direct competition and alteration of nutrient and disturbance regimes (Franklin and Molina-Freaner 2010, p. 1671).

Herbarium sheets contain labels that give information regarding where a specimen was collected, by whom, when the collection was made, and additional information such as what plant species were found in association with the collected specimen. There are no exotic species noted as associates on 39 of the 40 acuña cactus specimen herbarium sheets located at the Arizona State University, University of Arizona, or San Juan College Herbarium collections (ARIZ 2011, entire). These collections cover the range of the acuña cactus and date from 1952 through 2009. There was one specimen collected in 1982 that lists the exotic annual red brome grass as an associate. Although crimson fountaingrass found on nearby property was reported to be a possible threat to the acuña cactus near Ajo (Falk 2005, pers. comm.), no exotic grasses were noted within the Ajo, Little Ajo Mountains, or Coffeepot ACEC habitats

during field surveys in October 2011 (Service 2011, p. 4). One researcher familiar with all known populations of the acuña cactus noted no associated threats from exotic plant species in any population (Baker 2011, pers. comm.). In addition, researchers at OPCNM noted no present threats from any exotic plant species either within OPCNM or in populations of the Sonoran Desert National Monument (Rutman 2011, pers. comm.).

In summary, we have reviewed the available information on the effects of and occurrence of nonnative, invasive plants in or near populations of the acuña cactus in southern Arizona and in Mexico. Known populations of the acuña cactus are well distributed across southern Arizona and northern Sonora and occur in areas subject to effects from nonnative, invasive plant species. However, there are no populations of the acuña cactus that currently show evidence of effects from nonnative, invasive species, and just one 1982 report indicates the presence of an exotic plant as an associate of the acuña cactus. While nonnative, invasive species could negatively impact this species, our review of the best available information indicates nonnative species do not co-occur with the acuña cactus presently; therefore we conclude nonnative, invasive species do not pose a threat to the acuña cactus and its habitat.

Mining

The immediate threats from mining activity include the direct loss of individuals and habitat. Indirect impacts of mining activity include fragmentation of acuña cactus and associated pollinator populations, which can reduce genetic vigor of the cactus and result in degradation and fragmentation of habitat and dusting of individual cacti adjacent to mines and associated roads. The acuña cactus populations in OPCNM and the Sonoran Desert National Monument are protected from the immediate threats associated with mining due to their National Monument status (NPS 1997, pp. s–iii; BLM 2011, p. 12). Currently on the Coffeepot ACEC, mineral exploration and mining are encouraged (BLM 1988, pp. 55 and 71). The 2011 Draft RMP/EIS for the Sonoran Desert National Monument proposes to continue the mining closure within the Sonoran Desert National Monument (BLM 2011, p. 181). However, within this same document, alternatives outlined for the Coffeepot ACEC allow for mining activities, but with various restrictions depending on the alternative selected. Because mining of metallic and nonmetallic minerals will continue to be allowed within the Coffeepot ACEC under the revised Draft RMP/EIS (BLM 2011, pp. 154, 155, 196, 197), there is the continued potential for some loss of individual acuña cactus and fragmentation of acuña cactus and associated pollinator populations and habitat. There are no known mining activities planned on BLM properties, though a BLM parcel adjacent to populations on State lands near Florence may host a gravel mining operation in the future (Service 2011b, p. 1).

Mining activity on private land near Ajo has a long history; the New Cornelia copper mine was one of the first open pit mines in Arizona dating to 1854 (Arizona Mining Association 2011, entire). This mine was closed in 1985, and a 2008 investigation by company owners determined the mine would not be reopened due to current economic conditions (Ajo Copper News Oct 29, 2008). As of 2012, the mine remains closed.

The small populations of the acuña cactus that remain in Ajo may have been part of a much larger population that occurred before mining activity began, but there are no survey records for this species in the area prior to mining activity. As a result, it is unclear to what extent the acuña cactus and associated habitat were removed due to historical mining in this area, but there was certainly some loss of individual acuña cactus and habitat. Rutman (1995, p. 1) noted that on the east side of the Ajo rock dump, roads, wells, prospecting holes, rock piles marking mining claims, and past use of explosives occurred immediately adjacent to the acuña cactus plants. Rutman (2006, p. 1) noted that habitat was lost when Indian Hill Village Road was built and that occupied habitat may also have been lost where the following buildings and infrastructure now occur: Assembly of God Indian Mission, New Cornelia mine, parking lot for the mine lookout, baseball diamond, and the large informal parking lot to the north of the hill. It is possible that these populations were at one time connected with the few plants to the southeast of the open pit mine on BLM land. There is little doubt that the historical size and range of the Ajo area populations of acuña cactus have been reduced.

Mining threats on private lands near Florence are unknown. Threats from mining to the acuña cactus plants in Mexico are unknown.

We are aware of no acuña cactus populations that are currently impacted by active mining. It is reasonable to project that some mining will occur in the future that could affect acuña cactus populations near Florence, Ajo, and in the Coffeepot ACEC. However, these effects will occur in limited areas that do not support a majority of known individual acuña cactus. The acuña cactus populations will remain well distributed across their range even if future mining activities affect a few populations. Therefore, based on our review of the available information, we conclude that current and future mining activity is not a threat to the acuña cactus and its habitat.

Drought and Climate Change

Our analyses under the Act include consideration of ongoing and projected changes in climate. The terms ''climate'' and ''climate change'' are defined by the Intergovernmental Panel on Climate Change (IPCC). ''Climate'' refers to the mean and variability of different types of weather conditions over time, with 30 years being a typical period for such measurements, although shorter or longer periods also may be used (IPCC 2007, p. 78). Thus, the term ''climate change'' refers to a change in the mean or variability of one or more measures of climate (e.g., temperature or precipitation) that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (IPCC 2007, p. 78). Various types of changes in climate can have direct or indirect effects on species. These effects may be positive, neutral, or negative, and they may change over time, depending on the species and other relevant considerations, such as the effects of interactions of climate with other variables (e.g., habitat fragmentation) (IPCC 2007, pp. 8–14, 18–19). In our analyses, we use our expert judgment to weigh relevant information, including uncertainty, in our consideration of various aspects of climate change.

Climate change will be a particular challenge for biodiversity because the interaction of additional stressors associated with climate change and current stressors may push species beyond their ability to survive (Lovejoy 2005, pp. 325–326). The synergistic implications of climate change and habitat fragmentation are the most threatening facet of climate change for biodiversity (Hannah *et al.* 2005, p. 4). Current climate change predictions for terrestrial areas in the Northern Hemisphere indicate warmer air temperatures, more intense precipitation events, and increased summer continental drying (Field *et al.* 1999, pp. 1–3; Hayhoe *et al.* 2004, p. 12422; Cayan *et al.* 2005, p. 6; Seager *et*

al. 2007, p. 1181). Climate change may lead to increased frequency and duration of severe storms and droughts (Golladay *et al.* 2004, p. 504; McLaughlin *et al.* 2002, pp. 6072–6074; Cook *et al.* 2004, p. 1015).

The current prognosis for climate change impacts in the American Southwest includes fewer frost days; warmer temperatures; greater water demand by plants, animals, and people; and an increased frequency of extreme weather events (heat waves, droughts, and floods) (Weiss and Overpeck 2005, p. 2074; Archer and Predick 2008, p. 24). How climate change will affect summer precipitation is less certain, because precipitation predictions are based on continental-scale general circulation models that do not yet account for land use and land cover effects or regional phenomena, such as those that control monsoonal rainfall in the Southwest (Weiss and Overpeck 2005, p. 2075; Archer and Predick 2008, pp. 23–24). Some models predict dramatic changes in southwestern vegetation communities as a result of climate change (Weiss and Overpeck 2005, p. 2074; Archer and Predick 2008, p. 24), especially as wildfires carried by nonnative plants (e.g., buffelgrass) potentially become more frequent, promoting the presence of invasive, exotic species over native ones (Weiss and Overpeck 2005, p. 2075). The Sonoran Desert has experienced drought conditions since 1998 (Bowers 2005, p. 421; WRCC 2012, entire). Recent trends for the region predict that climate of the region will become much drier in the next 2 to 3 decades (Schwinning *et al.* 2008, p. 14–15). The impact of current and future drought, which may be long-term and severe (Seager *et al.* 2007, pp. 1183–1184; Archer and Predick 2008, entire), will continue to affect the acuña cactus and its habitat throughout its range.

Climate change is likely to affect the long-term survival and distribution of native plant species, such as the acuña cactus, through changes in temperature and precipitation. Over the past 40 to 50 years, the United States has experienced more extreme weather events, heat waves, and regional droughts than in previous decades (Karl *et al.* 2009, p. 27). The southwestern United States has experienced the greatest temperature increase in the continental United States; average temperatures increased approximately 0.8 degrees Celsius (°C) (1.5 degrees Fahrenheit (°F)) compared to a 1960 to 1979 baseline (Karl *et al.* 2009, p. 129). By the end of this century, temperatures averaged across the Southwest region are expected to warm a total of 2 to 5 °C (4 to 10 °F) above the historic baseline period of 1960–1979 (Karl *et al.* 2009, p. 129). The frequency and intensity of high temperature extremes will increase, and heat waves currently considered rare will become more common (Karl *et al.* 2009, pp. 33–34). This region has experienced drought conditions since 1998 (Bowers 2005, p. 421; Western Region Climate Center (WRCC) 2012, entire). Annual mean precipitation levels are expected to decrease in western North America and especially the southwestern States by midcentury (IPCC 2007, p. 8; Seager *et al.* 2007, p. 1181; Girvetz *et al.* 2009, entire). The current trend in the Southwest of less frequent, but more intense, precipitation events leading to overall drier conditions is predicted to continue (Karl *et al.* 2009, p. 24). The levels of aridity of recent drought conditions and perhaps those of the 1950s drought years will become the new climatology for the southwestern United States (Seager *et al.* 2007, p. 1181). In summary, the drought the southwestern United States has been experiencing since the late 1990s is the worst in over 100 years and is being exacerbated by record warming (Karl *et al.* 2009, p. 130).

Heat stress in adult cacti is minimal compared to other plant species as they are able to survive heat stress due to both morphology and metabolism (Smith *et al.* 1984, pp. 647, 650; Wahid *et al.* 2007, p. 199). In a study of Sonoran Desert cacti, Smith *et al.* (1984, pp. 647, 650) found that short cacti (such as the acuña cactus) and massive cacti had higher heat tolerance than most other cacti species studied, and more than vascular plants overall. They also found heat tolerance varied with stem orientation, stem diameter, and location on the landscape including a portion of the species' range (Smith *et al.* 1984, p. 649). Extreme temperatures can, however, negatively impact seedling survival in many Sonoran Desert plants, and drought coupled with high temperatures lessens temperature tolerance in seedlings (Nobel 1984, pp. 310, 316). We found no additional information on projections for cacti in general, or the acuña cactus in particular, indicating the impacts of increased heat stress combined with increasing drought stress as climate models project. We do know, however, that drought or high temperatures alone can damage non-cacti species, and the combination causes more detrimental interactive effects on these plants than either stressor independently (Huang and Jiang 2002, p. 288).

We are aware of several reports of drought stress apparent on individual acuña cactus. In cacti and other succulents, stem swelling and shrinking is typical with rain–drought cycles (Mauseth 2000, p. 1107). At OPCNM, monitored acuña cactus individuals were reported to have shrunk in size from one year to the next, and researchers noted shrinking individuals may be dying (Ruffner 1989, p. 1). In addition, 1986 datasheets from monitoring plots at OPCNM categorized cacti based on health of the individual; one category from the time was ''desiccated'' (dried out) (Buskirk 1986, pers. comm.). Although such descriptive categories have not been in use in monitoring for some time, OPCNM staff note their importance and would like to reinstate them in future monitoring (Holm 2012b, pers. comm.). In addition, plants already stressed from prolonged drought are more susceptible to insect attack and disease (Mattson and Haack 1987, p. 110), and such attack is prevalent in all acuña cactus populations across their range (see discussion in *Factor C. Disease or Predation*). Mortality in measured plots at OPCNM was most severe in 1993, when 40 adults were lost, and again in 1997, when 53 adults were lost; both of these were years with dry summers (WRCC 2012, entire). In the last decade, 78 adults were lost in these plots, and 25 of these losses occurred in the very dry year of 2007 (WRCC 2012, entire). During this same 10-year period, 31 new adults were recorded as additions to the population through recruitment (NPS 2011a, p. 2).

In addition to the health of adult individuals, drought is directly related to acuña cactus population health with regard to reproduction and establishment. In his 3-year study of the reproductive ecology of the acuña cactus, Johnson (1992, pp. 403, 405) concluded that the positive association of rainfall and annual variation in the number of flowers produced indicates that water availability limits flower production in this species. Although Johnson cites yearly precipitation in relation to flower production, it seems more likely that winter precipitation is the driving factor, as flowers are produced early in the spring following winter precipitation events. Within monitoring plots established by Buskirk in 1977 (Buskirk 1981, p. 1), total flowers counted peaked at 902 in 1992 (Holm 2006, p. 10); corresponding precipitation during the winter of 1992–1993 was 29.7 cm (11.66 in) (WRCC 2012, entire). By comparison, in the last 10 years of measurement, the average number of flowers counted in these plots was 198 (Holm 2006, p. 10); the corresponding average winter

precipitation during these years was 9.7 cm (3.8 in) (WRCC 2012, entire).

Resource limitation may affect the acuña cactus seed set through ovule abortion (Johnson 1989, p. 11). Because flowering commences in early March and fruiting commences in late April (Johnson 1989, pp. 5, 8), it is likely also that winter precipitation is correlated with fruit set. Fruit production was monitored at the OPCNM plots beginning in 2004, and has shown considerable variation since that time, with a low of 29 fruits produced in 2007, when total winter precipitation was 6.8 cm (2.69 in) and, a high of 361 fruits produced in 2005, when winter precipitation was 16.4 cm (6.47 in) (NPS 2011a, p. 1; WRCC 2012, entire).

Johnson (1989, pp. 5, 12) determined that acuña cactus seedling survival was dependent on summer precipitation and that soil moisture availability limits the distribution of the species. Rice (2001, pers. comm.) noted that in greenhouse trials of the acuña cactus, seedlings and new recruits were primarily lost due to desiccation; emphasizing that establishment is the most critical and limiting phase of the acuña cactus life cycle. Throughout the species' range, rainfall has been declining, and drought conditions have been dominant since 1998 (Bowers 2005, p. 421; WRCC 2012, entire); this has likely influenced seedling survivorship (Holm 2006, p. 2–1—2–13; NPS 2011a, p. 1). For example, in the measured plots at OPCNM, the recruitment rate peaked in 1992, coinciding with consecutive seasons with near to above average rainfall (NPS 2011a, p. 1; WRCC 2012, entire). In the Coffeepot Mountain BLM monitoring plots, seedling or juvenile plants were observed in all years when plots were measured; however, the number of dead plants far exceeded recruitment in any year (Butterwick 1982–1992, entire). In many site visits throughout the region over the past 10 years, there have been reports of low or no recruitment (Service 2008a, p. 1; Service 2008c, p. 1; Anderson, 2011, p. 2; Service 2011a, entire; Service 2011b, p. 3).

In summary, since the late 1990s, the southwestern United States has been experiencing drought conditions and increasing high temperatures. Climatic predictions suggest continued less frequent, but perhaps more intense, summer precipitation, reduced winter precipitation; and increasing temperatures in this region (Seager *et al.* 2007, p. 1181; Archer and Predick 2008, pp. 23–24; Karl *et al.* 2009, p. 24). Data from the acuña cactus monitoring plots at OPCNM and at Coffeepot Mountain, along with occasional surveys of these and most other populations, indicate major population declines have occurred across the acuña cactus range over the past 30 years. It appears that a combination of drought stress, warmer winters, and insect attack (see *Factor C. Disease or Predation,* below) have reduced adult plant numbers, while heat stress, lack of precipitation, and seed predation (see *Factor C. Disease or Predation,* below) have combined to reduce or halt reproduction. Because the current drought is occurring on a regional scale, and because climatic models predict future regional droughts, it is likely that all populations of the acuña cactus will continue to decline due to drought and the effects of climate change. In addition, it appears that drought and climate change in combination with insect damage and predation, as a combined effect, is the more likely scenario for rangewide level impacts to acuña cacti (see *Factor C. Disease or Predation,* below). Most, if not all, of the acuña cactus populations are impacted by drought and the effects of climate change, including effects to both individual cacti and to productivity and establishment. Therefore, based on our review of the available information, we conclude that drought and the effects of climate change, combined with insect predation (see *Factor C. Disease or Predation,* below), rise to a rangewide level threat.

Summary of Factor A

In conclusion, based on our review of the best available information, we have determined that individual plant loss, as well as fragmentation of acuña cactus and associated pollinator populations due to the effects of urbanization; livestock grazing; nonnative, invasive plant species; and mining do not impact the species at a population level and therefore are not threats to the acuña cactus. Currently, 78 percent of the known living acuña cactus individuals occur along the border near OPCNM. Cross-border violators and associated CBP and LE off-road activities may be affecting individual acuña cactus plants and their habitat. If there is an increase in off-road activities in or near acuña cactus populations or habitat, the likelihood of loss of individuals or loss or modification of habitat also increases. In addition, a large amount of mortality has been documented within all populations that have been visited more than once, relating to a combination of the intricately correlated increases in drought and heat stress, warmer winter temperatures, and insect attack (see *Factor C. Disease or Predation,* below). Thus, based on our review of the best available scientific information, we conclude that loss and degradation of habitat due to off-road border activities, drought, and climate change, are threats to the acuña cactus and its habitat.

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

Unauthorized collection has, in the past, been identified as a threat to the acuña cactus (Phillips *et al.* 1982, p. 9; Phillips and Buskirk 1982, p. 2; Rutman 1996a, pers. comm.; Rutman 2007, p. 6). At OPCNM, a large number of individuals are located adjacent to Puerto Blanco Drive, which was formerly a scenic loop drive. Although historically collection is suspected to have occurred in this population (Buskirk and Phillips 1983, pers. comm.; Rutman 1996a, pers. comm.), the significance of this past collection varies. Buskirk (1981, p. 5) noted that he did not believe collection was a significant source of mortality between 1977 and 1981, yet Phillips and Buskirk (1982, p. 2) noted three mapped roadside cacti lost to collectors, stating that collecting could be a significant cause of loss in OPCNM. Additionally, Rutman (1996a, p. 2) noted that along the scenic drive road at OPCNM, considerable collection of the largest size class of plants occurred. This road was closed to visitors in 2003, and there are no plans to reopen it, making it highly unlikely that collection is an ongoing issue (Rutman 2011, pers. comm.; Pate 2012a, pers. comm.).

On BLM-administered lands, the acuña cactus plants occur in very remote locations, and no reports of collection are known. Rutman (1995, p. 2) noted collection did not appear to be a threat to the population surrounding the Coffeepot Mountain plots during annual visits between 1988 and 1990. Similarly, no evidence of collection was seen during 2011 Service and BLM site visits to nearby populations within the Coffeepot ACEC (Service 2011a, p. 4).

On State and private lands in the Florence area, Rutman (1995, p. 3) noted that population locations were published and, easy to access, and that, for many years, collectors have been taking plants. She also noted individual plants seen the previous year were missing, and no carcasses found upon revisiting (Rutman 1995, p. 3). No evidence of collection from visited sites was found during 2011 Service visits (Service 2011b, p. 1). Private lands in the Ajo area are also accessible, though we have no reports of collection there.

Buskirk and Phillips (1983, pers. comm.) refer to some acuña cactus collection, but refer to it as relatively uncommon and unsystematic at present. No documented cases of unauthorized

collection (in violation of the Arizona Native Plant Law) of this cactus have been found in any of the known populations. Heil and Melton (1994, p. 15) note that the acuña cactus is easy to grow and raise from seed and that species is rare in the gardens of cactus collectors. An investigator within the Office of Special Investigations of the Arizona Department of Agriculture stated that he does not believe collection of the acuña cactus is a threat to the species (Reimer 2011, pers. comm.). Therefore, based on our review of the available information, we conclude that, while there is evidence that unauthorized collection of the acuña cactus did occur in the past, it occurs to such an insignificant extent currently that it is not a threat to the acuña cactus, nor do we expect it to become a threat in the future.

Factor C. Disease or Predation

In general, cacti are susceptible to attacks from numerous types of insects, and the acuña cactus is no exception. The interior flesh of cacti provides both a nesting area and food source for beetles, weevils, and other insects. Once an infestation has occurred, cacti can die from the eating and tunneling activities or from the introduction of fungus or disease. In addition, drought may cause physiological stress responses in plants, such as limiting their photosynthesis and cell growth. Plants already stressed from prolonged drought are more susceptible to insect attack and disease (Mattson and Haack 1987, p. 110).

There are four native insects that have been documented to impact the acuña cactus. Of these, cactus weevils (*Gerstaeckeria* spp.) and cactus longhorn beetle (*Moneilema gigas*) are documented to be most responsible for the acuña cactus declines (Rutman 2007, p. 6; Johnson 1989, p. 10). Cactus weevils are stem-boring insects; the adults feed externally while the larvae feed internally (Burger and Louda 1995, p. 1560). Cactus longhorn beetle adults feed on pads or terminal buds of cacti; their larvae burrow into stems or roots causing the severing of root and stem, collapse, and death of plants (Kelly and Olsen 2011, p. 7; Johnson 1989, p. 10). Raske 1966 (p. 106) cites Dodd (1927) stating that the cactus longhorn beetle has one reproductive cycle per year; however, a noted cactus expert, Alan Zimmerman, believes that increased warming in recent decades facilitates longer breeding cycles and more reproduction in both the cactus longhorn beetle and cactus weevil (Rutman 2007, p. 6).

Other insects with lesser impact on the acuña cactus are snout moth (*Yosemitia graciella*) larvae and unknown ant species. Snout moth larvae are noted to feed internally on cacti (Simonsen and Brown 2009, entire) and on fruits, thus reducing seed set (Johnson 1992, p. 405). Johnson (1992, p. 405) noted snout moth predation accounted for a reduction in seed set of 35 percent in 50 monitored plants at OPCNM. Ants have been noted in greenhouse conditions and in the wild to consume and transport the acuña cactus seeds (Butterwick 1982–1992, entire; Rutman 1996b, pers. comm.; Rutman 2001, pers. comm., p. 1; Anderson 2011, p. 1). In a similar species, *Coryphantha robustispina* ssp. *robustispina* (Pima pineapple cactus), ants have been documented eating fruits and transporting seeds (Baker 2011, pp. ii, 23). While ants do consume seed, they also scatter seed away from the mother plant thereby reducing predation by small mammals (O'Dowd and Hay 1980, p. 536; Vander Wall *et al.* 2005, p. 802). Ants may also aid in reducing the seedbank of competing plant species (O'Dowd and Hay 1980, p. 539). All of the above-mentioned insects have been documented at OPCNM near or on acuña cactus individuals (Johnson 1989, p. 10; Johnson 1992, p. 405; Rutman 1996b, pers. comm.; Rutman 2001, pers. comm., p. 1), with ants documented at Coffeepot Mountain (Butterwick 1982–1992, entire). It is likely that insect depredation occurs in other populations as well, though studies have not been conducted, and insects have not been collected in these populations. No diseases have been documented in the acuña cactus, though plants are exceptionally susceptible to bacterial rot after minor stem damage (Rutman 2007, p. 3). In 2011 site visits across the species' range, a majority of living adult acuña cacti were in various stages of decline, with stems blackening from the base upward and resulting in eventual cactus death. The cause of this blackening is unknown; it could be natural aging of the plants or the result of stress, insect damage, or disease.

A variety of small mammals, such as native ground squirrels, pack rats, rabbits, and mice, can severely damage or kill both mature and young cacti during times of drought (Kelly and Olsen 2011, pp. 8–9). There have been reports of loss of the acuña cactus due to small mammal depredation evidenced by scattered spines and rooted bases at OPCNM (Buskirk 1981, p. 5; Buskirk and Phillips, 1983 pers. comm.; Heil and Melton 1994, p. 15; Holm 2006, pp. 2–3). It is likely that small mammal depredation occurs in other populations outside of OPCNM as well, though studies have not been conducted and small mammal occurrence in these populations has not been documented.

In 2011, nearly all populations of the acuña cactus on BLM, State, and some private lands were visited by Service staff (Service 2011a, entire; Service 2011b, entire). In every population, some partially living and dead plants were found uprooted and toppled over. In 1996, there was a high mortality event associated with many live, reproductive plants found uprooted and lying on the ground in the Coffeepot Mountain population and the populations around Ajo (Rutman 2007, p. 3). There has been no explanation for this episode; however, there have been various hypotheses including vandalism, thrashers (birds) digging them up, and javelinas uprooting the plants. Given the severing of stem from root commenced when plants had been infested with cactus longhorn beetle, it is entirely possible that episodes of plants falling over occur following peak years for these insects, possibly in association with birds or other animals hearing and attempting to remove the insects within. There were above average temperatures in Ajo the 2 years preceding the 1996 uprooting event; this uprooting may have been correlated to increased insect activity and uprooting. There have been above average annual temperatures recorded at the Ajo Weather Station 15 times during 25 years of record keeping between 1975 and 2010 (WRCC 2012, entire). This trend is consistent both at OPCNM and in Florence, where 21 of 25 recent years and 19 of 25 recent years, respectively, had above average temperatures (WRCC 2012, entire). The increased warming in recent decades is likely benefiting insects and stressing acuña cactus plants, resulting in significantly increased mortality rangewide.

Between 1982 and 1992, both recruitment and mortality were recorded within and outside of the established BLM plots at the Coffeepot Mountain acuña cactus population. Field notes from throughout the 10-year period of study indicate insect damage to individual plants has been ongoing within this population. Field notes included the following comments: tubercles with holes, damage on apex, exposed root, numerous ants, plant dying, insect damage to fruit, hollow inside, uprooted, chlorotic (yellowing), beetle wounds on side, unhealthy, damaged meristem, appears dying at the base, base rotting, sickly, and not rooted (Butterwick 1982–1992). In 1987, the

BLM reported high mortality in this population with more dead plants observed (332) than living (310) (Rutman *et al.* 1987, p. 1). In 1989, the BLM reported a precipitous decline of this population (Johnson 1989, p. 18) with low or no recruitment since that time (Anderson 2011, entire). Within the monitoring plots at OPCNM, datasheets from 1986 categorized cacti as being: uprooted from the base, shell of spines, dead with upright carcass, stepped on, and missing, among others (Buskirk 1986, pers. comm., entire). Within these plots, adult recruitment has been observed in every year of monitoring since 1989; mortality has been observed in all but 2 years during this same period (NPS 2011a, p. 1). On average, the annual adult mortality within these plots is 12 percent, exceeding the annual recruitment of 7.7 percent (NPS 2011a, p. 1). The decrease in reproduction, increase in mortality, or a combination of both have resulted in the decline in plants within (NPS 2011a, p. 1) and outside of the plots at OPCNM. Across this population, the previous estimate of acuña cactus numbers were greater than 10,000 individuals (Buskirk 1981, p. 3); current estimates are between 1,000 and 2,000 plants total (Rutman 2011, pers. comm.).

Within monitoring plots at Coffeepot Mountain, population decline has been dramatic with at least two episodes of 50 percent reductions reported from individuals in and around monitoring plots (Butterwick 1982–1992, entire; Rutman *et al.* 1987, p. 2; Anderson 2011, p. 2; Anderson 2012b, pers. comm.); at OPCNM, there has been a documented decline in the number of individuals on all six monitoring plots in all but 2 years since 1989 (NPS 2011a, p. 1), and in total population estimates between 1981 and 2011 (Buskirk 1981, p. 3; Rutman 2011, pers. comm.). In 2011, site visits to most of the remaining populations on BLM, State, and private lands indicated large proportions of the populations were dead with many plants uprooted, hollow plants, and many individuals in all size classes reported to be unhealthy or blackening from the base (Service 2011a, entire; Service 2011b, entire). Also in 2011, researchers in Mexico reported that 58.8 percent of the 1,601 total plants found were dead (Pate 2012b, pers. comm.).

In conclusion, uprooting and depredation have been ongoing for at least several decades at OPCNM, at Coffeepot Mountain, and in all other populations. The pronounced decline in the acuña cactus numbers over the last three decades documented throughout the species' range on BLM, State, private, and lands in Sonora, Mexico, is of serious concern. It appears that the combination of drought stress and insect attack have reduced adult plant numbers and that warmer winters may be increasing insect numbers attacking acuña cacti. Most, if not all, of the populations are significantly impacted by predation; predation, in the form of insect attacks, occurs throughout the range of the acuña cactus. We also believe that the extent to which this threat affects the acuña cactus populations is interactive with the occurrence of drought and other climatic variables such as warmer winters. The ability of the acuña cactus populations to recover from insect attacks depends on the successful germination and survival of seedlings. However, these populations are also experiencing decreased reproduction, which may render the populations unable to recover as they continue to lose mature individuals, with low levels of seedling recruitment and survival. Therefore, based on our review of the available information, we conclude that predation is a threat that is resulting in significant population impacts to the acuña cactus, and this threat is expected to continue into the future.

Factor D. The Inadequacy of Existing Regulatory Mechanisms

Under this factor, we examine whether existing regulatory mechanisms are inadequate to address the threats to the species discussed under the other factors. Section 4(b)(1)(A) of the Act requires the Service to take into account ''those efforts, if any, being made by any State or foreign nation, or any political subdivision of a State or foreign nation, to protect such species * * *.'' We interpret this language to require the Service to consider relevant Federal, State, and Tribal laws, plans, regulations, cooperative agreements, and other such mechanisms that may minimize any of the threats we describe in threat analyses under the other four factors, or otherwise enhance conservation of the species. We give strongest weight to statutes and their implementing regulations and management direction that stems from those laws and regulations. An example would be State governmental actions enforced under a State statute or constitution, or Federal action under statute.

Having evaluated the significance of the threat as mitigated by any such conservation efforts, we analyze under Factor D the extent to which existing regulatory mechanisms are inadequate to address the specific threats to the species. Regulatory mechanisms, if they exist, may reduce or eliminate the impacts from one or more identified threats. In this section, we review existing State and Federal regulatory mechanisms to determine whether they effectively reduce or remove threats to the acuña cactus.

Regarding the threat of unauthorized collection, the acuña cactus is protected by the Arizona Native Plants Law, which prohibits collection without obtaining a permit on all public lands, and directs that plants may not be moved off of private property without contacting the Arizona Department of Agriculture. Due to the difficulty in implementing this law, it has not been effective in reducing impacts from collection, nor does it protect habitat. However, no documented cases of unauthorized collection of this cactus have been found in any of the known populations in recent decades. There is little threat of collection on private lands due to restricted public access (see Factor B); the majority of the acuña cactus populations are on State and Federal lands. In addition, NPS regulations prohibit the collection or removal of the acuña cactus on NPS lands, where the largest known acuña cactus population occurs. The main road accessing the acuña cactus population in Acuña Valley in OPCNM is closed to the public, thus reducing impacts from collection to this population. Although the remoteness of many populations limits both visitation and enforcement of the existing regulatory mechanisms, unauthorized collection is reported to result in a relatively minor impact to this species. We conclude that the regulations that exist to protect against the impacts from over collection of the species, primarily the NPS regulation prohibiting removal and the closure of the primary access route in OPCNM, are serving to reduce the impacts from collection.

There are no regulations in place that address threats to acuña cactus and its habitat from site degradation or that address the primary threats to acuña cactus of insect predation, drought, and the effects of climate change. Urban development; livestock grazing; nonnative, invasive plant species; unauthorized collection, and mining are not identified to occur at a level that is a threat to acuña cactus populations. However, without management of impacts from these activities, impacts could rise significantly. There are special management prescriptions in place to address some of these concerns on Federal lands. For example, the Sonoran Desert National Monument and OPCNM exclude livestock grazing and mining; promote the reduction of

nonnative, invasive plant species; and are unlikely to support urban development. In Mexico, a portion of the known population is within the boundary of Pinacate Biosphere Reserve, which may afford some protections. While management prescriptions with regard to these stressors may be applied opportunistically across different land management agencies within the region, they do afford some protection and minimize impacts to the species and its habitat.

With respect to threats to the species caused by activities along the U.S.-Mexico border, there are a number of Memorandum of Understanding and Biological Opinion documents that dictate certain actions be taken by CBP to reduce effects to resources in the United States and Mexico border region. These documents are primarily associated with habitat of the federally listed Sonoran pronghorn antelope (*Antilocapra americana* ssp. *sonoriensis*) and off-road activity, specifically identifying sensitive areas to avoid. These Memorandum of Understanding and Biological Opinions do provide some relief from the threats caused to the species resulting from cross-border violators and CBP enforcement activities because the acuña cactus shares a portion of the pronghorn habitat and these documents limit some direct impact to habitat. Likewise, CBP-sponsored projects, including the mapping of off-road tracks and revegetating unauthorized roads, may also benefit the species (Holm 2012a, pers. comm.). In cooperation with Service staff, CBP has begun efforts to educate Border Patrol agents on the locations and appearance of acuña cactus so that areas that support the species can be avoided to the maximum extent possible. Designated critical habitat in OPCNM will be marked on road atlases being prepared by OPCNM staff and provided to the agents patrolling in the OPCNM area. In addition, the efforts of CBP to stop cross-border violators in recent years by means of traffic barriers and other infrastructure has greatly reduced cross-border violator activities and afforded some protection to the habitat. However, due to the difficulty and ever-changing status of border issues, compliance with these agreements has been difficult. Reports indicate a two-track road and associated cross-border violator clothing were found in 2010 within one of the six long-term monitoring plots at OPCNM. The cross-border violator activities are, by their very nature, in violation of the law and regulations. Therefore, we believe that regulations designed to protect the species and its habitat will be generally of little impact to alleviate the threats caused by activities of cross-border violators. As noted above, the interdiction efforts of the U.S. Border Patrol (USBP), including patrols, electronic surveillance and fence construction have contributed to a significant reduction in cross-border violator off-road traffic that has benefited the acuña cactus and other species. However, we do not find regulatory mechanisms to be adequate to directly address these threats discussed in Factor A.

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

We have evaluated the best available scientific information, and we did not find any indication of potential threats related to this factor. We considered such threats as small population size and overall rarity of the acuña cactus, but we did not find any indication that these are threats to the species. Therefore, we conclude that other natural or manmade factors are not threats to the acuña cactus.

Proposed Determination for the Acuña Cactus

We have carefully assessed the best scientific and commercial information available regarding the past, present, and future threats to the acuña cactus. We find that the species is in danger of extinction due to the current and ongoing modification and destruction of its habitat and range (Factor A) from long-term drought, effects of climate change, and ongoing and future border activities. The acuña cactus habitat is impacted across its range by long-term drought, warmer winters occurring in the past several decades and projected to continue with climate change, and insect predation. In addition, the majority of the acuña cactus individuals (78 percent) occur within 16.5 km (10.25 mi) of the border in either OPCNM or Sonora, Mexico. As described above, the complexities of addressing off-road excursions by cross-border violators result in unpredictable actions on the part of CBP and LE and threatens acuña cactus and its habitat. The primary threats to the species are due to drought, climate change, and insect predation. These threats are exacerbated at local scales by off-road excursions by cross-border violators and CBP and LE response. We do not find any threats to the species from unauthorized collection (Factor B). We find that predation, in combination with drought and heat stress, exacerbates the threats to this species (Factor C). Although mechanisms are in place that afford some protection to the species and its habitat with regard to potential stressors to the species, there are no regulations in place to address insect predation, drought, and the effects of climate change. With regard to off-road border activity, although the interdiction efforts of CBP, including patrols, electronic surveillance and fence construction have contributed to a significant reduction in cross-border violator off-road traffic that has benefited the acuña cactus and other species, regulations have little impact to alleviate these threats. Therefore, we do not find regulatory mechanisms to be adequate to directly address these threats discussed in Factor A. Finally, we find other natural or manmade factors are not threats to the acuña cactus (Factor E).

The elevated risk of extinction of the acuña cactus is a result of the cumulative stressors on the species and its habitat. Mortality of more than 80 percent of individuals has been documented within populations that have been surveyed more than once. This loss has also occurred on protected lands with ongoing management efforts for the acuña cactus, showing both a rapid and a severe decline to the species. In the acuña cactus, water and heat stress reduce flower and seed production, and seedling survival is dependent on summer precipitation and soil moisture. Warmer and drier winters combined with increased insect attack, negatively impacts the survivorship of reproductive adults. Of the remaining living individuals across the species' range, a large portion were in various stages of deteriorating health, primarily blackening from the base upward, when visited by a botanist in 2011. Across populations, minimal or no recruitment has been seen in recent years. Throughout the species' range, rainfall has been declining, and drought conditions have been dominant for several decades; climate change is anticipated to increase drought periods and warming winters. This combination is expected to continue the documented trend of mortality exceeding recruitment across all populations. When mortality exceeds recruitment in a population, the result is often a declining population. Given this, we consider none of the populations to be stable or secure. The factors significantly threatening the species are not expected to be abated in the foreseeable future, and some populations may have decreased to levels where they are no longer viable. All of the threats, combined with high

levels of mortality and low recruitment in the populations, contribute to a substantial risk of extinction and lead to our finding that the acuña cactus is in danger of extinction throughout its range; therefore, the species meets the definition of endangered.

The Act defines an endangered species as any species that is ''in danger of extinction throughout all or a significant portion of its range'' and a threatened species as any species ''that is likely to become endangered throughout all or a significant portion of its range within the foreseeable future.'' We find that the acuña cactus is presently in danger of extinction throughout its entire range based on rangewide documented rapid loss of individuals, decline in the health of many remaining individuals, little to no recruitment, and continuation of the threats, as described above. Therefore, on the basis of the best available scientific and commercial information, we propose listing the acuña cactus as an endangered species in accordance with sections 3(6) and 4(a)(1) of the Act.

Listing the acuña cactus as a threatened species is not the appropriate determination because the ongoing threats described above are severe enough to create the immediate risk of extinction. The continued loss of reproductive adults and juveniles poses a significant and immediate risk of extinction to the species throughout the species' range, and are not restricted to any particular significant portion of that range. All of these factors combined lead us to conclude that the threat of extinction is high and immediate; thus, we conclude that the acuña cactus meets the definition of an endangered species.

Under the Act and our implementing regulations, a species may warrant listing if it is an endangered or threatened species throughout all or a significant portion of its range. The threats to the survival of the species occur throughout the acuña cactus' range and are not restricted to any particular significant portion of that range. Accordingly, our assessment and proposed determination applies to the species throughout its entire range.

Fickeisen Plains Cactus

It is our intent to discuss below only those topics directly relevant to the listing of the Fickeisen plains cactus as endangered in this section of the proposed rule.

Species Description

The Fickeisen plains cactus is a small, unbranched to occasionally branched, globose (globular) cactus that retracts into the soil after flowering and fruiting. Stems of mature Fickeisen plains cactus are 2.5 to 6.0 cm (1.0 to 2.4 in) tall and up to 5.5 cm (2.2 in) in diameter (Benson 1982, p. 749; Arizona Rare Plant Guide Committee 2001, unpaginated). The stems are covered with tubercles; each tubercle has 3 to 7 radial spines, 4 to 7 millimeters (mm) (0.15 to 0.27 in) in length, and 1 central spine (15 to 18 mm (0.59 to 0.70 in) long) that distinguishes the variety *fickeiseniae* from the variety *peeblesianus* (Benson 1982, p. 765). The central spine is whitish and curved upward. All spines are corky (spongy). The flowers are 2.5 cm (0.98 in) in diameter, cream-yellow or yellowish-green in color, and produced on the apex of the stem. Flowers bloom from mid-April to mid-May, opening in the mid-morning for 1 to 2 days. An entire population generally completes anthesis (the period when the flower is open and functional) in 7 to 14 days (Travis 1987, p. 6), depending on the weather conditions (Navajo Natural Heritage Program (NNHP) 1994, p. 4). Fruits are produced in mid-May, are turbinate (top-shaped), and turn reddish-brown at maturity (AGFD 2011a, p. 1). The seeds are dark brown to black, 3 mm (0.11 in) long, and 2 mm (0.08 in) wide (AGFD 2011a, p. 1). The life span of the Fickeisen plains cactus is estimated to be between 10 to 15 years (Phillips *et al.* 1982, p. 9).

Taxonomy

The Fickeisen plains cactus was discovered near Cameron, Arizona, in the late 1950s, and was described in the scientific literature by Heil *et al.* (1981, pp. 28–31).

The name *Pediocactus peeblesianus* var. *fickeiseniae* had not been validly published. Heil *et al.* (1981, p. 31) recognized the name and taxon in a review of the genus *Pediocactus,* and this name is accepted in the Flora of North America (Heil and Porter 2003, p. 213). Based on these references, we consider *Pediocactus peeblesianus* var. *fickeiseniae* to be a valid taxon. Other synonyms of *Pediocactus peeblesianus* var. *fickeiseniae* that have been used are *Navajoa fickeisenii* and *Toumeya fickeisenii* (Benson 1982, p. 955).

The genus *Pediocactus* contains seven species; six of these are rare endemics of the Colorado Plateau region in Arizona, Colorado, New Mexico, and Utah (Benson 1982, p. 749). There are two recognized varieties of *Pediocactus peeblesianus,* variety *peeblesianus* (Peebles Navajo cactus) and variety *fickeiseniae* (Porter 2002, pp. 15–16). According to Benson, the structural differences exhibited by *Pediocacti* among various sites, coupled with a poor seed dispersal mechanism and specializations to specific geology or soil type, indicate that the existing plants are probably relicts of a once widespread genus with a distribution fractured by climatic conditions (Benson 1982, p. 750).

Biology

The general biology of the Fickeisen plains cactus is similar to other species in the genus *Pediocactus.* The Fickeisen plains cactus is a cold-adapted plant that retracts into the soil during the winter (cold) and summer (dry) seasons, as well as during drought conditions. Plants may be completely buried underground or shrink down into the soil until the crown sits flushed with the soil surface (Phillips *et al.* 1982, p. 4). When temperatures rise in the spring and with adequate rainfall, plants emerge from beneath the surface to flower in mid-April. Spring flowering is believed to be influenced by cold temperatures and precipitation from the preceding winter months (Brack 2012, pers. comm.). After flowering and prior to the summer heat, plants set seed in June and shrink into the soil, losing one-half their height above ground. Some plants may re-emerge in the autumn following monsoonal rains. The length of time a plant remains retracted can vary between individual plants. Hughes (2000a, p. 2) has documented some plants remaining retracted underground for at least 3 years. The Fickeisen plains cactus is also subject to root rot during very wet years and frost heaving. Locating individuals of the Fickeisen plains cactus can be difficult, even when their exact location is known, and therefore, searches are best done during their flowering period.

Reproduction has not been specifically studied on the Fickeisen plains cactus. However, reproduction for plant species in the genus *Pediocactus* occurs by cross-pollination (Pimienta-Barrios and del Castillo 2002, p. 79). Species of small native bees are the primary pollinators. Species of hover flies and bee flies have also been observed visiting flowers of the Fickeisen plains cactus (Milne 1987, p. 21; NNHP 1994, p. 3; Peach *et al.* 1993, pp. 312–314; Tepedino 2000, p. 7; Tepedino 2012, pers. comm.). Hughes (1996a, p. 50) found that flowering and fruiting in the Fickeisen plains cactus occurs once an individual plant grows to 10 mm (0.39 in) in diameter and as an individual increases in size more fruit are produced. Specifically, he documented individuals less than 20.9 mm (0.82 in) in diameter produced 1.37 fruit on average (range of fruit produced

1 to 3) compared to individuals at 50 mm (1.97 in) and larger, which produced 3.60 fruits on average (range of fruit produced 2 to 5). This correlation between larger sized individuals and increased fruit production has also been found in other *Pediocactus* species (Phillips *et al.* 1989, p. 4; Hreha and Meyer 2001, p. 86). This information suggests that larger, older individuals contribute more to the population growth rate by potentially having a greater influence on seed output than smaller, younger plants. Based on long-term monitoring information for the Fickeisen plains cactus, the majority of individuals observed tend to range between 20 mm (0.79 in) and 30 mm (1.18 in) in diameter.

Population monitoring of the Fickeisen plains cactus suggests that this variety has a low reproductive capacity. In examining long-term monitoring information by the BLM, fruit production occurred irregularly over a 22-year period with 35 percent, on average, of the population reproducing. Hughes (2011, pers. comm.) found that 30 to 40 seeds are generally produced from a single fruit, and believed that low seed production hinders substantial increases in plant abundance from occurring, even during favorable weather conditions that would support germination (Hughes 1996a, p. 50). Thus, significant episodes of recruitment within populations on BLM lands reportedly occurred two to three times over a 9-year period from 1986 to 1995 (Hughes 1996a, p. 50). Phillips and Phillips (1995, p. 12) reported similar results for the Peebles Navajo cactus in which they documented moderate increases in population numbers roughly two to three times every 10 years. Episodic recruitment may play a role in increasing the threats to the species because adult mortality may continue at a high rate between periods of recruitment, lowering the reproductive potential of the population when conditions are favorable for seed germination.

The mechanisms of seed dispersal in the Fickeisen plains cactus have not been investigated and are poorly understood. Most site visits to populations of the Fickeisen plains cactus have observed seedlings established very close to the adult plant (Goodwin 2011a, p. 9; NNHP 1994, p. 4). The general shared belief is that most species of *Pediocactus,* including the Fickeisen plains cactus, lack a good mechanism for seed dispersal, which is a contributing factor to its endemism and widely scattered, isolated populations (Benson 1982, p. 750; Milne 1987, p. 4).

Habitat

The Fickeisen plains cactus is a narrow endemic restricted to exposed layers of Kaibab limestone on the Colorado Plateau. Plants are found in shallow, gravelly loam soils formed from alluvium, colluvium, or Aeolian deposits derived from limestone of the Harrisburg member of the Kaibab Formation and Toroweap Formation; Coconino Sandstone; and the Moenkopi Formation (Travis 1987, pp. 2–3; Arizona Geological Survey (AZGS) 2011; Natural Resources Conservation Service (NRCS) 2012). Most populations occur on the margins of canyon rims, on flat terraces or benches, or on the toe of well-drained hills with less than 20 percent slope; at elevations between 1,280 to 1,814 m (4,200 to 5,950 ft) (Arizona Rare Plant Guide Committee 2001, unpaginated; AGFD 2011b, entire; Hazelton 2012a, pers. comm.). Habitat of the Fickeisen plains cactus is within the Plains and Great Basin grasslands and Great Basin desert scrub vegetation communities (Benson 1982, p. 764; NatureServe 2011). Dominant native plant species that are commonly associated with these biotic communities include: *Artemisia tridentata* (sagebrush), *Atriplex canescens* (four-wing saltbush), *Atriplex confertifolia* (shadscale), *Bouteloua eriopoda* (black grama), *Bouteloua gracilis* (blue grama), *Bromus* spp. (brome), *Chrysothamnus* spp. (rabbit-bush), *Ephedra torreyana* (Mormon tea), *Eurotia lanata* (winterfat), *Gutierrezia sarothrae* (broom snakeweed), *Pleuraphis jamesii* (James's galleta), *Oryzopsis hymenoides* (Indian ricegrass), *Sphaeralcea* spp. (globe-mallow), and *Stipa* spp. (needlegrass). Other native cactus species that are commonly found include *Agave utahensis* (century plants) and *Echinocactus polycephalus* spp. (Brown 1994, pp. 115–121; Turner 1994, pp. 145–155; Hughes 1996b, p. 2; Goodwin 2011a, p. 4; NatureServe 2011). The *Escobaria vivipara* var. *rosea* (foxtail cactus) is typically found in close association with the Fickeisen plains cactus (Hughes 1996a, p. 47).

The climate of the Great Basin Desert and on the Colorado Plateau is highly variable. The climate of the region is influenced by events in the tropical Pacific and northern Pacific Ocean (United States Geological Survey (USGS) 2002, p. 2). The amount of precipitation received locally varies by elevation and topography, and is patchy in its distribution. Precipitation is bimodal, occurring in the winter (January to March) and summer (July to September) months. The average annual precipitation ranges from 15.2 to 35.5 cm (6 to 14 in) per year; snowfall accumulation averages 22.9 cm (9 in), primarily from January to February (WRCC 2012, entire). Winter precipitation is thought to be critical for the region to ensure soil moisture recharge and a reliable spring growing season (Travis 1987, p. 3; Comstock and Ehleringer 1992, pp. 196–199).

Biological soil crusts are found on the Colorado Plateau in or near the Fickeisen plains cactus' habitat (United States Forest Service (USFS) 1999, entire; BLM 2007a, p. 3–15). Biological soil crusts are formed by a community of living organisms that can include cyanobacteria, green algae, microfungi, mosses, liverworts, and lichens (Belnap 2006, pp. 361–362). These crusts provide many positive benefits to the larger vegetation community by providing fixed carbon and nitrogen on sparsely vegetated soils, soil stabilization and erosion control, water infiltration, improved plant growth, and seedling germination (Rychert *et al.* 1978, entire; NRCS 1997, pp. 8–10; Floyd *et al.* 2003, p. 1704; Belnap 2006, entire).

Distribution and Range

The Fickeisen plains cactus is found only on the Colorado Plateau in Coconino and Mohave Counties. The range of the Fickeisen plains cactus encompasses the Arizona Strip (i.e., the area north of the Colorado River to the Arizona-Utah border) from Mainstreet Valley in Mohave County to House Rock Valley in Coconino County, along the canyon rims of the Colorado River and Little Colorado River, to the area of Gray Mountain, and along the canyon rims of Cataract Canyon on the Coconino Plateau. The majority of the populations are small; some consisting of a few individuals (Table 3). Populations are widely scattered over a broad range and separated by topography. There seems to be abundant suitable habitat that is unoccupied by the plant for reasons unknown. One estimate of the range of the Fickeisen plains cactus is 12,750 square kilometers (sq km) (4,922 square miles (sq mi)) (NatureServe 2011, p. 2). We do not know what information was used to derive this estimate, and, therefore, it may not accurately reflect the current known range. The range of the Fickeisen plains cactus converges with the range of the endangered *Pediocactus bradyi* (Brady pincushion cactus) in House Rock Valley, and overlaps with the range of the threatened *Pediocactus sileri* (Siler pincushion cactus), and the *Pediocactus*

paradinei (Kaibab plains cactus), which is protected by a conservation agreement on the Arizona Strip (BLM 2011a, Figure 3.8–1).

Very little is known about the historical range of the Fickeisen plains cactus. Benson (1982, p. 765) described the range as northern Arizona from the hills in northeast Mohave County to the vicinity of the Colorado and Little Colorado rivers near the Grand Canyon National Park and southeast Coconino County. He estimated the known range to be about 200 km (125 mi) of land. Based on the current spatial distribution of the Fickeisen plains cactus, the plant's range has expanded roughly 72 km (45 mi) west of the Kaibab Plateau in Mohave County to include occupied areas in Mainstreet Valley, Hurricane Cliffs, and Clayhole Ridge on the Arizona Strip.

The Fickeisen plains cactus population near Cataract Canyon was recently documented in 2006. The population is located below the Colorado River and south of the Grand Canyon National Park on the Cataract Ranch but does not appear to represent a range expansion for the species. Benson had identified two areas as occupied by *Pediocactus peeblesianus* varieties that correspond to the location of this population (Benson 1982, p. 765). One area, located below the Colorado River, was identified as a Fickeisen plains cactus occurrence. The second occupied area was located farther south of there but identified as a Peebles Navajo cactus occurrence. Both of these areas were later inventoried as part of a floristic survey in 2006, and the variety of *Pediocactus peeblesianus* observed was documented as the Fickeisen plains cactus (Goodwin 2006, p. 4; Goodwin 2011a, pp. 5–6).

The Fickeisen plains cactus has also been documented on State land within the Boquillas Ranch, which is located to the west of the Cataract Ranch and is privately owned by the Navajo Nation (Goodwin 2006, p. 5; Chapman 2012, pers. comm.). Besides location coordinates, we do not have information describing the status of the Fickeisen plains cactus there. According to Goodwin (2006, pp. 4–5), two German botanists had discovered plants of *Pediocactus peeblesianus* on the Coconino Plateau in 1979, but the plants were thought to be of the variety *maianus.* Based on their field notes, visits to the area between 1980 and 2006 confirmed the locations of three occupied sites by the *Pediocactus peeblesianus,* later documented as the Fickeisen plains cactus. Two of these sites were on the Cataract Ranch while the third site is on State land leased to the Boquillas Ranch (Chapman 2012, pers. comm.). This area was revisited in 2012, but no documentation describing the site visit is available (Goodman 2012, pers. comm.; Hazelton 2012b, pers. comm.). Anecdotal information suggests that additional Fickeisen plains cacti and an abundant suitable habitat occur on the Boquillas Ranch (Chapman 2012, pers. comm. Goodwin 2012, pers. comm.). If additional Fickeisen plains cacti do exist here, it would increase the known range and distribution of the plant.

Abundance and Trends

About 1,150 Fickeisen plains cacti among 33 populations have ever been documented rangewide from 1962 to 2011 (Table 3) (AGFD 2011b, entire; Goodwin 2011a, p. 19; NNHP 2011a, entire). However, 504 individuals among 6 populations have been recently documented and are a subset of the 1,150 individuals. This difference in the number of individuals does not necessarily represent a decline; survey information for the remaining 27 populations is absent, and therefore their status is unknown. Additionally, the increase in plant numbers in the Cataract Canyon population from 2007 to 2011 is due to better detection between years and not to greater abundance. Based on these six documented populations, the breakout of the land ownership follows: BLM (26 percent), Kaibab National Forest (status unknown), State of Arizona (32 percent), the Navajo Nation (14 percent), and privately-owned lands (29 percent).

TABLE 3—TOTAL DOCUMENTED FICKEISEN PLAINS CACTUS NUMBERS

[1962 to 2011]

Population	Land owner	First visited	First count	Last visited	Last count
Beanhole Well	BLM	1979	3	1979	3
Marble Canyon	BLM	1979	8	1979	8
Gray Mountain (Mays Wash)	BLM	1981	29	1981	29
South Canyon	BLM	1979	41	1987	52
Toquer Tank	BLM	1986	8	1994	7
Navajo	BLM	1986	4	2001	10
Salaratus Draw I and II	BLM	1986	17	2001	0
Temple Trail	BLM	1986	7	2001	7
Ward	BLM	1986	12	2001	10
Sunshine Ridge II	BLM	1986	9	2004	35
Clayhole Ridge	BLM	1987	23	2011	42
Dutchman Draw	BLM	1986	167	2011	12
North Canyon	BLM	1987	16	2011	39
Sunshine Ridge	BLM	1987	12	2011	34
Kaibab National Forest	Forest Service	Unknown		2004	Unknown
Shinumo Wash	NN	1993	9	1993	9
Tiger Wash 2	NN	1993	11	1993	11
Little Colorado River Overlook	NN	1956	Unknown	1997	15
Little Colorado River Gauging Station	NN	1999	1 (survey out of season).	1999	1
29 mile Canyon	NN	2000	2	2000	2
Big Canyon	NN	2002	15	2002	15
West of Hellhole Bend	NN	2002	5	2002	5
Small Ridge	NN	2004	1 (survey out of season).	2004	1
Little Colorado River Gravel pit	NN	1956	Unknown	2005	21
Shinumo Altar	NN	1991	Unknown	2005	7
Tiger Wash 1	NN	1993	30	2005	2
Gray Mountain (South of Cameron)	NN	1962	4	2009	3

TABLE 3—TOTAL DOCUMENTED FICKEISEN PLAINS CACTUS NUMBERS—Continued

[1962 to 2011]

Population	Land owner	First visited	First count	Last visited	Last count
Hellhole Bend	NN	2009	314	2009	314
Salt Trail Canyon	NN	2006	119	2011	70
Blue Spring	NN	2005	30	2005	30
Gray Mountain (Sewage Disposal Pond)	Private	1984		1984	4
Cataract Canyon	Private	2007	54	2011	146
Cataract Canyon	State	2007	98	2011	161
TOTAL					1, 105

Notes: Navajo Nation (NN).

TABLE 4—NUMBERS OF FICKEISEN PLAINS CACTI RECORDED IN BLM MONITORING PLOTS AND CLUSTER PLOTS

[1986 to 2011]

Year	Dutchman	Clayhole	Sunshine Ridge	North Canyon	Navajo	Sunshine Ridge II	Salaratus I and II	Temple Trail	Toquer Tank**	Ward	Total
1986 Plants outside plots*.	167	8	9				17				201
1986	21		6	14	4	2		5	8	10	70
1987	107	23	12	16					7		165
1988	102	35		27					9		173
1989	185	31	8	28					9		261
1990	186	32	33	33					6		290
1991	194	37	43	36					13		323
1992	219	44	44	7					7		321
1993	168	34	32	13	0		13	1		0	261
1994	168	38	35	16			44		7		308
1995	188	30	25	11							254
1997	122	21	7	21							171
1998	49	16	6	26							97
1999	45	17	5	28							95
2000	37	20	Not Observed.	22							79
2001	40	63	3	34	10	23	0	7	0	10	190
2002	30	60	12	24							126
2003	50	56	Not Observed.	24							130
2004	45	59	7	40							151
2005	34	59	33	40							166
2006	36	48	26	32							142
2007	32	38	30	39							139
2008	23	40	23	33							119
2009	33	37	33	31							134
2011	12	42	34	39							127

Notes: * BLM reported counts of Fickeisen plains cacti outside of established monitoring plots for 1986 only. No monitoring occurred in 1996 by the BLM due to dry conditions resulting in plants retracted underground. No monitoring reports were submitted to the Service for the years 2010 and 2012.

Our knowledge of abundance and trend information was assessed from annual monitoring reports by the BLM (1986 to 2011) and Navajo Nation (2006 to 2011). Each agency has monitoring plans that are set up to track specific information in each of their populations. However, there are differences in data collection, and this inconsistency makes it difficult to compare trends across the landscape and ownerships. Therefore, results are presented for each landowner separately. No monitoring program has been established for the Fickeisen plains cactus on the Kaibab National Forest and the Cataract Ranch.

Trend information from the five monitored plots indicates that these populations have experienced significant declines in plant numbers. Plant numbers in the four BLM plots increased by approximately 98 percent from 1987 to 1992, but declined by 59.5 percent from 1993 to 2011 (Table 4). The reported decline is based on the number of tagged Fickeisen plains cactus that are present (emergent and alive) during the monitoring period. If an individual tagged plant is retracted underground during the monitoring period, it is counted as missing or retracted but is not included in the live plant count. If that plant does not emerge after 3 consecutive years, the BLM will mark the plant as dead. The Salt Trail Canyon plot on the Navajo Nation plot shows a 49 percent decline over the last 5 years. This decline is also based on the number of live, emergent plants counted during the monitoring period. Plants that are reportedly dead or missing are tallied separately in each successive year that monitoring occurs.

Bureau of Land Management Lands—The BLM manages habitat for 13 documented Fickeisen plains cactus populations (Table 3) that occupy an estimated 36.9-ha (91.3-ac) area (BLM 2007b, p. 67) on the Arizona Strip. The total known population on the Arizona

Strip has declined from 323 individuals in 1991 to 127 individuals in 2011 (Table 4).

The Fickeisen plains cactus was first documented on the Arizona Strip in 1977 at Sunshine Ridge with the remaining populations discovered up through 1986 (Phillips 1979, entire; AGFD 2011b, entire). The populations are widely separated from one another (roughly 31 km (19 mi) apart) in geographically disjunct locations. In Mohave County, populations have been documented in Mainstreet Valley near Dutchman Draw, in Hurricane Valley near Toquer Tank, in Lower Hurricane Valley near Temple Trail, in Salaratus Draw in the Hurricane Cliffs, on Clayhole Ridge, and on Sunshine Ridge. Populations have also been documented in Coconino County near the canyon rims of Marble Canyon, South Canyon, and North Canyon Wash in House Rock Valley. Searches for the Fickeisen plains cactus after 1987 have not located any additional occurrences despite the abundance of suitable habitat present (Hughes 1996a, p. 47; Hughes 2011, pers. comm.).

In 1986, the BLM established long-term monitoring at the Dutchman Draw, North Canyon wash, Clayhole Ridge, and Sunshine Ridge populations (Hughes 1996a, p. 47). The plots were located in populations that contained the densest number of Fickeisen plains cacti and were easily accessible (Hughes 2009, p. 28; Hughes 2011, pers. comm.). They were visited each year from 1986 to 2009, and in 2011, to record information on abundance, size (diameter), reproduction, recruitment, mortality, and missing or retracted plants. BLM classified plants into five different size classes based on measured width between 1987 and 1995. After 1997, two size classes were used to reflect the juvenile (0 to 15 mm (0.6 in)) and adult (16 to 31 mm and greater (0.63 to 1.22 in)) size classes. The changes to the size classes prevents comparing the data among years; however, it does provide some information regarding the proportion of the population in the small and larger size classes that can be used to describe recruitment. Besides the four plots, BLM established seven cluster plots: Navajo, Ward, Salaratus Draw 1, Salaratus Draw 2, Sunshine Ridge 2, Temple Trail, and Toquer Tank. Cluster plots consist of rebar centered among a small number of scattered individuals. These are visited once every 5 to 10 years for the purpose of recording presence/absence.

Dutchman Draw—The Dutchman Draw plot is the largest plot, situated within tall, dense grass in Mainstreet Valley. It has experienced a 95 percent decline in the last 18 years. Up until 1999, plant numbers in the plot accounted for 64 to 74 percent of the total reported numbers for the Arizona Strip population. Abundance in this plot increased during the late 1980s from 167 individuals to a high of 219 plants in 1992. As of 2011, only 12 plants occur in the plot. The plot experienced its highest number of seedlings from 1989 to 1992, a period when the BLM recorded plants in the smallest size class. Only one other seedling was detected in 1994. Between 1997 and 2005, the two size classes were relatively equal. After 2007, the larger size class showed an upward trend, while a significant drop occurred in the smaller size class. This gap between the two size classes has continued through 2011, in which 83 percent of the plot's individuals are adult plants. There were a total of 111 plants counted as recruitment (plants with a diameter less than 20 mm (0.79 in)) with an average of 7 individuals per year; 94 percent of those were reported from 1994 to 2004. On average, 31 percent of tagged plants fruited in 5 of the 22 years of percent fruiting was recorded. From 2001 to 2011, 174 plants were reported missing or retracted (average 35 plants per year). Mortality totaled 257 plants over a 15-year period from 1987 to 2011 with 144 of those occurring in the year 2000. The BLM stated that the 144 mortalities included tagged plants that that were previously counted as retracted plants but because they had not been seen since the late nineties, they were assumed to be dead (Hughes 2000a, p. 2). In summary, this plot has shown a continued decline since 1992. Although many plants are within reproductive age, there have not been any significant increases in plant numbers. Mortality and the number of plants missing or retracted have been higher than the number of new recruits. With only 12 plants in 2011, we believe this plot could be extirpated in the near future.

Clayhole Ridge—The Clayhole Ridge plot occurs on top of a limestone ridge (BLM 2007b, p. 67). Plant numbers have varied with a high of 63 individuals (2001) and a low of 16 individuals (1998). Since 2001, plant numbers have declined by 33 percent. As of 2011, the plot has 42 plants. No seedlings were reported from 1987 to 1995, when the small size classes were measured. During that period, 76 percent of the individuals were greater than 20.1 mm (0.79 in) in diameter, while 9 percent were less than 10 mm (0.39 in) in diameter. The gap between the small and larger size classes has continued through 2011, with 88 percent of the individuals in the larger size class. Hughes (1996b, p. 17) attributed this division to the lack of intensive surveys for seedlings. This plot had the highest percent of cactus producing fruit and in the most years compared to the other plots. Fruiting production occurred in 16 of the 22 years reported with 6 to 85 percent of tagged cactus fruiting in any given year. New recruits, however, appeared to be low, with a total of 34 new plants (average of 2 per year) reported in 11 of the 16 years. There were a total of 40 mortalities between 1988 and 2005, and 251 plants were reported missing or retracted from 1998 to 2009 (average of 21 plants per year). In summary, abundance has varied in this plot overall. Since 2001, plant numbers have declined by 33 percent. Even with the high number of plants that produced fruit and considering that larger individuals produced multiple fruit, recruitment appears to be poor. Mortalities, in combination with the number of plants missing or retracted, are substantially high in light of overall plant numbers. The years between 2000 and 2001 are the exception, when plant numbers increased from 20 to 63. Reasons attributed for the sharp increase are unknown and do not appear to be correlated to weather, as the spring of 2000 was very dry (Hughes 2000a, p. 1).

Sunshine Ridge—The Sunshine Ridge plot is located along a ridgeline and downslope on a bench next to Toroweap Road (Hughes 1996b, p. 17). This plot has experienced great variations in plant numbers. Monitoring began with six plants in 1986, and as of 2011, the plot contained 34 plants. Plant numbers fluctuated from a high of 44 (1992) to none being observed in 2000, because they were either retracted or dead (Hughes 2000a, p. 1; Hughes 2005a, pers. comm.), possibly in response to below-average precipitation that year. The plot had two distinct periods of relatively high numbers; from 1990 to 1995, with an average of 35 plants, and from 2005 to 2011, with an average of 29 plants. The worst years occurred in between these peaks. The plot was vandalized in 1996, which may have contributed to the significant decline, although plants were not observed to have been damaged by the vandalism (Hughes 2005a, pers. comm.). From 1987 to 1995, 77 percent of individuals were greater than 10.1 mm (0.40 in) in diameter, while only two very small plants were discovered during this period. From 1997 through 2011, the majority of the plants were in the larger size class which currently includes 85 percent of the individuals in this plot.

Fruit production occurred in 10 of the 22 years, with 16 to 79 percent of tagged cacti fruiting. A total of 26 new recruits (average 1.7 per year) occurred in 7 of the 16 years reported. A total of 43 plants died, with 74 percent of those mortalities occurring from 1989 to 1995. There was also a total of 45 plants reported missing or retracted (average of 4 per year), with 82 percent of these reports occurring from 2006 to 2009. In summary, this plot has experienced great fluctuations in numbers but has maintained an average of 21 plants over the years. Reasons for the fluctuations have not been fully investigated. Despite a high percentage of plants fruiting, only two seedlings were documented over a 16-year period. Both mortality and the number of plants missing or retracted exceeds the number of new recruits. The status of the species in the plot appears to be unstable and trending towards decline.

North Canyon—The North Canyon Plot occurs in House Rock Valley on two small hills near North Canyon wash. As of 2011, the plot contained 39 plants. Plant numbers have also varied and have not been investigated. From 1987 to 1991, plant numbers increased by approximately 55 percent, then declined by approximately 81 percent in 1992. The sharp decline was attributed to a high number of plants lost from rodent predation in 1992. Post 1992, plant numbers have gradually increased to a high of 40 in 2004 and 2005, and currently fluctuate between 31 and 39 individuals. Size structure has been dominated by larger individuals since 2000; few to no seedlings have been reported. From 1988 to 1995, 85 percent of plants were greater than 10.1 mm (0.40 in) in diameter. No small-sized plants were found during these years. From 1997 through 2002, the size class distribution was relatively equal. After 2002, a shift occurred, with an increase in the number of individuals in the larger size class and a decrease in the number in the smaller size class. Currently, 90 percent of plants are in the larger size class. Fruit production occurred in 11 of the 22 years reported, with 8 to 64 percent of tagged cactus fruiting. There were 31 new recruits (average of 2 plants per year) in 10 of 16 years reported. There were a total of 37 mortalities, including the 26 deaths in 1992. A total of 72 plants were reported missing or retracted (about 6 plants per year); 65 percent of those occurred from 2002 to 2005, when the plot also increased in numbers. In summary, the plot has maintained between 31 and 39 individuals since 2004. Given the size structure, the plot appears to be dominated by aging adult cactus. Very few small plants were documented between 1986 and 1995. In addition, mortality, combined with the number of plants missing or retracted, exceeds recruitment. This plot is trending towards decline due to poor recruitment and the current size-class distribution.

Information collected on the seven cluster plots was reported in BLM's 2001 annual monitoring report and is limited to count data (Roaque 2012, pers. comm.). The Navajo and Ward clusters plots are located in proximity to the Dutchman Draw population. In 1986, 4 plants were found at Navajo and 12 at Ward. Visits to these sites in 1993 reported zero plants in both plots. These sites were last visited in 2001 and 10 plants each were found in both plots. No information describing the 1993 visit was provided in the monitoring report. Reported numbers for Salaratus Draw 1 and Salaratus Draw 2 were 5 and 12, respectively in 1986 (BLM 1986, p. 2) and, 2 and 11 plants, respectively in 1993. In 1994, the Service visited Salaratus Draw sites and counted 14 plants in Salaratus Draw I and 30 plants in Salaratus Draw II (Brooks 1995, p.1). Both of these sites were last visited in 2001 and zero plants were reported (Roaque 2012, pers. comm.). We do not have locations of these sites, in relation to the other, on file. Because the BLM referred to these sites as simply Salaratus Draw in their 1986 annual monitoring report and we do the same in this document unless specificity between the two sites is called for. The Sunshine Ridge II cluster plot had 9 plants in 1986 and 23 plants in 2001. The Temple Trail cluster plot had 5 plants in 1986, 1 plant in 1993, and 7 plants in 2001.

The Toquer Tank cluster plot was visited regularly from 1986 to 1991. The reported number of plants found during that time ranged from 8 in 1986, up to 13 in 1991, to 7 in 1994 (Table 4) (Roaque 2012, pers. comm.; AGFD 2011b, entire). Information from BLM's annual monitoring reports for the years 1995 through 2000 noted ''no observations'' for the Toquer Tank cluster plot but did not provide an explanation to what this meant. We do not know if this signifies that the cluster plot was not visited or whether a visit did occur but no Fickeisen plains cacti were observed at the time. Subsequently, the BLM no longer included Toquer Tank in their monitoring reports.

Despite the confusion with Toquer Tank and the length of time since the Salaratus Draw cluster plots were last visited, we believe these areas may still be occupied by the species. When Hughes last visited Salaratus Draw I and II in 2001, he noted that both sites were very dry (Roaque 2012, pers. comm.) and plants may have been retracted at the time. Hughes further noted that the cluster plots are located in areas with dense grass in which, the plants are difficult to find if they are not in bloom. We do not have any additional information to describe the conditions at the Toquer Tank cluster plot; however a visit to the area is warranted. We are seeking any information about the status of the Fickeisen plains cactus at these three areas, specifically information to describe abundance, health, and age-class diversity of the plants. We also seek information describing the status of its habitat and any land use activities occurring within occupied areas (see Information Requested).

We also have limited information about the three populations located in House Rock Valley where the Fickeisen plains cactus has been documented, but these areas have not been visited in over 18 years. The populations are located at Beanhole Well, Marble Canyon, and South Canyon in House Rock Valley near the North Rim of the Grand Canyon National Park. The Beanhole Well population is located north of the South Canyon site and just south of Highway 89A near the Vermillion Cliffs. This is a small population that was discovered in 1979, and contained only three plants (Anderson and Gierisch 1979, p.1; AGFD 2011b, entire). Field notes described the plants as healthy, scarce, and with several size classes present. The site had been revisited by Hughes, and while occupied habitat was observed, no plant numbers were reported to us (Calico 2012, pers. comm.). The only available information about the Marble Canyon site was that 8 plants were documented there in 1979 within a 100-by 100-m area (0.06-by 0.06-mi) (Phillips 1979, p. 3). Near the canyon rim of South Canyon, a total of 41 plants among three populations were observed in 1979 within a 1,000-by 200-m (0.62-by 0.12-mi) area. Only three plants were noted having several size classes present; plants appeared healthy but scarce. In 1987, 52 plants were observed during a soil study at the South Canyon site (AGFD 2011b, entire). Travis (1987, p.4) observed animal burrows at the site with the Fickeisen plains cactus found in the disturbed ground. A short-term monitoring plot was established there from 1982 until 1989 (Phillips *et al.* 1982, p. 7). The only available information described poor recruitment

in the plot, which was attributed to below average precipitation (Service 2001a, p. 1). The site was last visited in 1993 by Hughes (Roaque 2012, pers. comm.), who had observed several Fickeisen plains cacti but did not provide specific information on plant numbers. We are seeking any information about the status of the populations at these three areas, specifically information to describe abundance, health, and age-class diversity of Fickeisen plains cactus. We also seek information describing the status of its habitat and any land use activities occurring within occupied areas (see Information Requested).

Navajo Nation Lands— The Navajo Nation lists the Fickeisen plains cactus as a Group 3 species on the Navajo Endangered Species List, which is a ''species or subspecies whose prospects of survival or recruitment are likely to be in jeopardy in the foreseeable future'' (Navajo Nation Division of Natural Resources 2008). There are 15 known populations of the Fickeisen plains cactus on the Navajo Nation (NNHP 2011a, p. 1). Eleven populations contain fewer than 20 plants, while three and possibly five populations contain only two to three individuals (Table 3). Three hundred and fourteen plants occur in a single population discovered in 2009. This site was visited in February 2012 with monitoring planned in the near future. Only 4 of the 15 populations have been visited more than one time by the Navajo Nation Heritage Program staff (NNHP 2011a, p. 1). They reported substantial decreases in plant numbers recorded during their most recent visits to two of these populations; the other two populations appeared stable. We do not have information on the total amount of occupied habitat of the Fickeisen plains cactus on the Navajo Nation.

Surveys for the Fickeisen plains cactus on the Navajo Nation occurred in 1994, when 280 individuals were located (NNHP 1994, p. 3). Re-surveying of known populations between 2004 and 2005 resulted in only half of the 15 populations located and substantially fewer plant numbers than the 280 previously reported (Roth 2005, pers. comm.). In 2006, a monitoring plot was established at one of their largest populations (Salt Trail Canyon) (Roth 2007, p. 3). The plot has been monitored annually except for 2010, to estimate population trends and record reproductive efforts.

In 2006, 119 plants were recorded within the plot. Plant numbers increased to 143 individuals in 2007, but this rise was primarily due to increased survey efforts that year (Roth 2008, p. 6). Since 2007, plant numbers have declined by 49 percent with 70 plants found as of 2011 (NNHP 2011b, p. 2). In 2009, 31 plants were found dead or could not be relocated with 8 new recruits. In 2011, 28 plants were found dead or were not located with one new seedling observed (NNHP 2011b, p. 3). Of the remaining plant in the plot, their observed condition, mean diameter, and reproductive output declined as well. From 2006 to 2008, the majority of plants were rated in excellent condition. The number of plants rated fair or poor increased from 4 in 2008, to 23 in 2009. These patterns may have been influenced by above-average rainfall in 2005 and 2007, but below-average precipitation in 2008 through 2010, on the Navajo Nation (NNHP 2011b, p. 3). The mean diameter of plants between 2008 and 2009 was 28 mm (1.10 in). By 2011, the mean diameter declined by 5 mm (0.20 in) as a result of the cactus shrinking rather than a loss of plants in that size class. The plot has been dominated by the larger size classes with 1 percent of the plants recorded as seedlings. Reproductive structures observed in 2009 and 2011 were flower buds, flowers both at and past their peak, and aborted flower buds, an observation which was similar to phenological results in 2008. In general, reproductive effort in 2009 was moderate, while in 2011 it was extremely low compared to 2008. In 2008, 205 reproductive structures were observed on 98 plants, and this was attributed to above-average rainfall in 2007, whereas 2008 and 2010 had below-average rainfall (NNHP 2011b, p. 3). In summary, short-term results demonstrate a continued decline over the last 5 years. Mortality, combined with the number of plants missing between years, is exceeding the number of smaller, young plants observed. In addition, the reproductive output appears to be low, in that no fruit were observed, and was likely influenced by below-normal precipitation.

Kaibab National Forest Lands—The Kaibab National Forest has recorded two limited occurrences of the Fickeisen plains cactus (USFS 2005, p. 148; AGFD 2011b, entire). These occur near the National Forest boundary of the North Kaibab Ranger District below the eastern and western edges of the Kaibab Plateau. The total number of plants that occur is unknown, but the population is considered to be small with only a few individuals (Phillips 2005, pers. comm.). Additionally, the amount of habitat is considered to be very limited and located in remote areas far removed from management actions. Beyond their discovery, the Kaibab National Forest has not monitored these plants. Occupied areas are managed for multiple uses but the predominant uses are wildlife habitat, livestock grazing, and recreation. Additional suitable habitat is believed to exist in the Lower and Upper Basin areas on the Tusayan Ranger District. Surveys for the Fickeisen plains cactus are needed in order to verify this (USFS 2009, p. 72).

State and Private Lands—A large occurrence of the Fickeisen plains cactus was documented in 2006, near the rim of Cataract Canyon on Cataract and Espee Ranches, which is owned and managed by Babbitt Ranches, LLC. These ranches are located on the Coconino Plateau south of the Grand Canyon National Park. The land within Cataract Ranch includes 18,210 ha (45,000 ac) of private land and 53,823 ha (133,000 ac) of land leased from the State of Arizona (The Nature Conservancy (TNC) 2000, p. 4). On December 7, 2000, TNC acquired 13, 953 ha (34,480 ac) of the privately owned parcels and placed these lands under a conservation easement; TNC refers to the easement land as the Cataract Natural Reserve Land (TNC 2000, p. 22). The easement land forms a large contiguous block in the southern portion of Cataract Ranch, but is interspersed among numerous parcels of State land in the northern portion of the ranch (TNC 2000, p. 3). The Espee Ranch is adjacent to the western boundary of the Cataract Ranch and includes State and private lands. Surveys for the Fickeisen plains cactus on the Espee Ranch were planned for spring of 2012; the status of that survey is unknown.

From 2006 to 2011, Goodwin located 307 Fickeisen plains cacti at 37 sites while conducting a general floristic inventory on the Cataract and Espee Ranches (Goodwin 2006, p. 7; Goodwin 2008, pp. 8–10; Goodwin 2011a, pp. 1–9). The number of plants recorded at each site was detected using a 5–10 minute visual search of the area (Goodwin 2011b, pers. comm.). About 146 Fickeisen plains cacti are located on the Cataract Natural Reserve Land, and 161 plants are on State land (Goodwin 2011a, pp. 18–20). Only two mature plants were located on the Espee Ranch. Goodwin defined sites as physical breaks in the habitat separating one occupied area from another (Goodwin 2011b, pers. comm.). Occupied sites had an average of 8.3 plants (range of 1 to 32 individuals) within a 0.10-ha (0.25-ac) or smaller sized area. About 30 percent (92 of 307 plants) of the plants observed were classified as immature

plants that appear to be of less than breeding age. The distribution of the plants appears to be loosely associated with the Cataract drainage. Most occupied areas occurred no farther than 3.22 to 4.83 km (2 to 3 mi) from the rim of the canyon and covered a 48-km (30-mi) linear area (Goodwin 2011a, p. 7). No formal surveys or permanent monitoring plots have been established.

The Fickeisen plains cactus has been documented on a mix of Federal, tribal, and private land near the vicinity of Gray Mountain. These areas have not been visited for many years, and the status of the plants is unknown. Information from the AGFD Heritage Data Management System noted that a Fickeisen plains cactus found on the Navajo Nation near the town of Gray Mountain was collected as a herbarium specimen in 1962 (AGFD 2011b, entire). This site was believed to have been revisited in 1977, but location information provided from that visit was too vague. The area was last visited in 2009 by the Navajo Nation botanist and three plants were found (NNHP 2011a, p. 2). In 1984, four Fickeisen plains cacti were found in the same vicinity, south of the Navajo Nation but on private land near a sewage disposal pond on the western side of Highway 89. This site has not been revisited since 1984. Across the highway on the eastern side, 29 live and 4 dead Fickeisen plains cacti were found in 1981. The AGFD Heritage Data Management System noted that plants were scattered near Mays Wash where BLM, State, and privately owned lands occur (AGFD 2011b, entire); however the location information suggests most plants are found on BLM lands. In 1983, a monitoring plot was established but there is no information that describes those efforts or results. The area was last visited in 1984, and four plants were observed, three of which were in bloom.

In summary, of the 1,150 Fickeisen plains cacti among 33 populations that have been documented since 1962, we only have recent information pertaining to the status of 504 individuals among 6 populations. We acknowledge that additional Fickeisen plains cacti may be present in the other 27 known populations, but these have not been visited for over 18 years, and the status of the plant is unknown. Of the six populations, five are currently monitored. These five plots are within the largest populations on the Arizona Strip and one of the largest populations on the Navajo Nation. Long-term results from the BLM show a 59.5 percent decline in plant numbers for the four monitored plots combined since 1992. The decline appears to be a result of higher rates of missing or retracted plants and mortality over several consecutive years and low seedling recruitment. Adult plants, which produce more fruit and have a greater reproductive output then immature plants have been removed from the BLM populations and are not being replaced by new recruits. Short-term monitoring results from the Salt Trail Canyon population on the Navajo Nation indicate plant numbers have declined by 49 percent in the last 5 years. This population is also dominated by older adult individuals that appear to have low reproductive output based on aborted reproductive structures observed in 4 of the 5 years monitoring occurred, with high mortality compared to recruitment.

Of these five populations, the observed decline in seedling recruitment and survival is difficult to attribute to a single cause; it is more likely associated with a combination of environmental factors that are acting together. The reproductive capacity for the Fickeisen plains cactus is considered to be naturally low (e.g., low seed production and poor dispersal mechanism), in which, introducing external factors that may place additional stress on the life history characteristics of these populations may further inhibit population growth. Because these five monitoring plots are located in large populations and have demonstrated significant decreases in plant numbers, it is likely that the smaller, isolated populations whose status is unknown are experiencing similar declines. The Fickeisen plains cactus on the Cataract Ranch is the exception. This population is the only location showing relatively good age-class diversity (30 percent of the population is considered to be immature); however, there is no long-term monitoring information for this area to draw conclusions. This area has the largest population of the Fickeisen plains cactus, but only 29 percent of those individuals are protected under the conservation easement.

Based on the best available information on the species, the known numbers of the Fickeisen plains cactus have declined. It is likely that the species will continue to decline, for the reasons described below, as mature plants die and few seedlings are present to replace them. The viability of the five monitored populations has been reduced due to low recruitment and the loss of mature, reproductive plants. If the threats described below continue to affect these populations, the long-term viability of the populations may be compromised. We acknowledge that the observed declines are restricted to monitoring plots that may not accurately reflect rangewide trends. In addition, our inability to say with certainty that plants that have been recorded as missing or retracted are dead may mean that we have underestimated the decline. However, we conclude, based on the information analyzed, that the largest populations have declined, and that recruitment is reduced or nonexistent for the monitored populations.

Summary of Factors Affecting the Fickeisen Plains Cactus

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

Based on the habitat characteristics described above, potential factors that may affect the habitat or range of the Fickeisen plains cactus are discussed in this section, including: (1) Livestock grazing; (2) nonnative, invasive species; (3) uranium mining; (4) road construction and maintenance; (5) ORV use and recreation; (6) commercial development; and (7) drought and climate change.

Livestock Grazing

The habitat of the Fickeisen plains cactus has been grazed since the late 1800s, and continues to be used for grazing by cattle, domestic sheep, and feral horses. In general, livestock grazing may result in direct loss or damage to the Fickeisen plains cactus and the habitat that supports its persistence as a result of trampling, compacting soil, increasing erosion, losing the soil seed bank, introducing invasive species, and disturbing native pollinators (Klemmedson 1956, p. 137; Ellison 1960, p. 24; Fleischner 1994, entire; Trimble and Mendel 1995, pp. 234–240; Kearns *et al.* 1998, p. 90; DiTomaso 2000, p. 257). For the Fickeisen plains cactus, the risk of trampling is greatest when plants emerge above ground at the same time that cattle occupy the area. Given their small size and lack of hard spines, plants are vulnerable to being stepped on and may be killed or damaged as a result (Phillips and Phillips 1995, p. 6). During the wet winter months when rainfall is sufficient, water may collect in pockets of bedrock on the canyon rims, attracting livestock to these areas. Although most plants retract in winter, those plants whose crown sits above the surface are still vulnerable to trampling and risk damage to their meristem. Plants can also be dislodged by cattle as they wander through an occupied area. Increased grazing pressure can

negatively impact Fickeisen plains cactus habitat. The soil where plants occur is shallow, sandy, and easily compactible, and may be covered by biological soil crusts, which are easily damaged by trampling (NRCS 1997, p. 10; Evans and Johansen 1999, p. 185). Livestock concentrating within occupied areas can lead to soil compaction and erosion that may decrease the ability of the soil to store seed and support seedling establishment, and may prevent plants from seasonally retracting underground (BLM 2007b, p. 74).

Bureau of Land Management Lands—Livestock grazing has occurred on the Arizona Strip and within the habitat of the Fickeisen plains cactus since the mid-1800s (BLM 2007a, p. 3–123). Unregulated use of the rangeland between the late 1880s and early 1900s resulted in overgrazing and rangeland deterioration. The passage of the Taylor Grazing Act (43 U.S.C. 315) in 1934 led to grazing reform and the establishment of allotments, kind and number of livestock, and seasons-of-use. Between the late 1950s and 1980s, the BLM made further adjustments in livestock numbers and the season-of-use, and implemented regulated grazing systems and management plans. Compared to 1900s, the current permitted level of grazing has been substantially reduced. The land and the vegetation community is slowly recovering, with habitat improvements noted by the BLM over the last several decades. Although populations of the Fickeisen plains cactus persisted during past years of overgrazing, we do not have information to describe any historical effects grazing may have had to the plant.

All habitat occupied by the Fickeisen plains cactus on the Arizona Strip occurs within active grazing allotments (BLM 2007b, p. 67). The Dutchman Draw plot is located in the Mainstreet Allotment and within a transitional pasture that is used in May for 2 to 4 weeks; the Clayhole Ridge plot is located within a single pasture of the White Pockets Allotment and has season-long grazing from mid-October to June; the Sunshine Ridge plot is within the Wildband pasture of the Wildband Allotment that is used from mid-June to September; and the North Canyon plot is within Rider Point pasture of the Soap Creek Allotment that has winter-spring use. The Salaratus Draw population is in the Salaratus pasture that is used in the winter season. Plants in the Temple Trail cluster plot are in the Temple Trail Allotment, Beanhole Well plants are in the Beanhole Allotment, and Toquer Tank plants are in the Toquer Tank Allotment (BLM 2008a, Appendix C). The Beanhole, Soap Creek, Temple Trail, and Wildband Allotments are categorized as ''improve allotments.'' These are ''managed to improve resource conditions or conflicts and receive the highest priority for funding and management actions'' (BLM 2007a, p. 3–124). The Mainstreet, Toquer Tank, and White Pockets Allotments are managed as ''maintain allotments.'' These allotments are managed ''to maintain current satisfactory resource conditions and are actively managed to ensure that resource values do not decline'' (BLM 2007a, p. 3–124). The Mainstreet Allotment is managed under a best pasture system, which attempts to match cattle movements with variable precipitation patterns and seasonal forage production rather than strict rotational schedules (Howery *et al.* 2000, entire). Forage utilization levels for key species are authorized at the 50 percent average of the current years' growth (BLM 2007a, 3–125). We do not have trend information describing rangeland conditions for the pastures occupied by the Fickeisen plains cactus. Available information indicates varying levels of grazing use across occupied habitat on the Arizona Strip (Brooks 1995, p.1; Roaque 2011, pers. comm.).

Impacts associated with livestock grazing have documented direct mortality to the Fickeisen plains cactus from trampling. Over a 17-year period, monitoring by the BLM detected 12 Fickeisen plains cacti killed from trampling. Three plants died at Clayhole Ridge following heavy spring rains. Hughes (1988, p. 2) documented cattle had congregated in the area of the Fickeisen plains cactus, and it appeared that considerable bull fighting occurred, resulting in disturbance to the plant and the soil. Seven plants died from trampling at Sunshine Ridge, including a large mature plant and five seedlings in 2001 (Hughes 2004, p. 2), and two plants died from trampling at Dutchman Draw (Hughes 2000a, p. 2). In House Rock Valley, the risk of trampling to the Fickeisen plains cactus may be greatest during the wet winter months when rainfall is sufficient to provide water for cattle on the canyon rims and into occupied habitat (Hughes 2001, pers. comm.). Because not all plants retract completely underground, directly stepping on the plant can damage the meristem and prevent flower production in the future.

There is evidence from other monitored *Pediocactus* species that trampling can impact numerous plants and often results in direct mortality. The BLM conducts similar monitoring for the *Pediocactus bradyi* (Brady pincushion cactus) as they do for the Fickeisen plains cactus. Over a 14-year period, Hughes (2005b, p. 17) reported two plants killed in the monitored plots from trampling. However, in response to the Service's concern for grazing impacts to the Brady pincushion cactus, the BLM established linear transects to determine livestock damage to the Brady pincushion cactus along the rim of Marble Canyon (Service 2001b, entire). The results showed that 15 Brady pincushion cacti were killed from trampling in the 3 years the transects were monitored (Hughes 2005b, p. 17). Hughes commented that the soil was wet and hoof prints were deep in the soil. Clark and Clark (2008, p. 3), monitoring the *Pediocactus winkleri* (Winkler pincushion cactus), found that 58 of 107 (54 percent) plants were stepped on directly by cattle over a 13-year period, with some plants stepped on more than once. Thirty-five of those plants died immediately from being trampled, while of those that survived, 60 percent eventually died within 4 years of their trampling injury. This provides some evidence that damage caused to plants from trampling may not be readily apparent immediately after the event. We anticipate that more Fickeisen plains cacti have died from being stepped on, either immediately or later in time, but are not being detected through the current monitoring methods (Service 2000, p. 2; Service 2007a, p. 8).

In the House Rock Valley, past heavy use of the range, in conjunction with arid conditions and drought, has resulted in degradation of the rangeland (Grand Canyon Trust (GCT) 2011) and slowed grassland regeneration. The North Canyon population was located in the Cram Allotment, which has been conjoined into the Soap Creek Allotment within the Kane Ranch. The BLM had identified the western half of the Cram Allotment as having a severe overgrazing problem historically and up until 1996. The North Canyon population occurred in the area heavily grazed (Hughes 2000b, p. 21). An October 1995 site visit to the Cram Allotment by Service staff reported that the number of cattle had been reduced from 150 head yearlong to 50 head in the winter-spring season due to the poor condition of the allotment (Brooks 1995, p. 1). In 1995, the BLM installed new water sources on the eastern half of the allotment and blocked water tanks from filling up on the western half. This was anticipated to reduce livestock use on the western half and help to alleviate grazing pressure within occupied Fickeisen plains cactus habitat (Hughes 2000b, p. 22). In 2003 to 2004, the

permittee of the Cram Allotment, now Soap Creek Allotment sold all of the livestock and grazing ceased on the Kane Ranch until 2005. During the period from 2003 to 2005, the Fickeisen plains cactus in the North Canyon plot experienced the greatest increase in the number of plants observed in the plot since 1986.

In 2005, the GCT and Conservation Fund purchased the grazing lease and currently maintain a reduced number of cattle on the allotment compared to previous levels (GCT 2011). They conducted a baseline ecological assessment and found nonnative, invasive species, particularly cheatgrass, abundant on the Kane Ranch in House Rock Valley and the range in poor quality likely from past heavy winter grazing. In addition, rangeland recovery has been slow due of the arid climate and drought conditions, such that forage productivity, vegetative cover, and soil stability are low (GCT 2011). The GCT began an experimental reseeding project and is investigating restoration techniques of the desert grassland community. These efforts, if successful, would improve the quality of habitat for the Fickeisen plains cactus.

In summary, the Fickeisen plains cactus populations on BLM lands are within active grazing allotments. The timing of when cattle are present within occupied Fickeisen plains cactus habitat varies among the four populations but corresponds to the periods when the plants are emergent, and also when they flower and produce fruit. Direct mortality from trampling has resulted in the documented loss of 12 plants, but more plants have likely been affected. Over time, losses to mature individuals or damage caused by trampling that prevents future reproduction will result in population declines. The rangeland that supports habitat for the Fickeisen plains cactus experienced past overgrazing. Although current grazing levels are far reduced from historic levels, the rangeland continues to be grazed during periods of drought. Information from the BLM and GCT suggests that the seasonal variation and changes in the timing of precipitation have resulted in slowed recovery of the rangelands from historic overgrazing and heavy, winter grazing over the past few years. These effects have likely diminished the quality of suitable habitat, particular in the Sunshine Ridge and North Canyon wash plots that are being managed to improve resource conditions or conflicts. Both of these plots have shown great fluctuations in plant numbers that may be correlated with habitat deterioration from livestock grazing coupled with climate conditions. In addition, heavy use in occupied Fickeisen plains cactus habitat during times when the plant may already be stressed from drought may be contributing to the plant's poor or nonexistent germination and recruitment. The Fickeisen plains cactus appears to be able to rebound when the grazing pressure has been removed, as demonstrated in the North Canyon plot. However, if the population numbers are too low—such as the Dutchman Draw plot—recovery may be very slow, or may not occur.

Navajo Nation Lands—Livestock grazing on the Navajo Nation has occurred since the 1880s, primary by domestic sheep and cattle. Stocking rates and the impact of grazing on the landscape have varied over the years (NNHP 2011a, p. 2). Overgrazing was documented in the past (Libecap and Johnson 1980, pp. 71–75; Richmond and Baron 1989, entire) and remained problematic through the mid-1990s (HCN 1996, p. 2). We do not have information on the current grazing levels, but similar to the BLM land, drought conditions have compounded rangeland recovery from past heavy use necessitating balancing rangeland capacity, family-owned herd sizes, and local economies (Redsteer *et al.* 2010, pp. 5–6, 11). Navajo Nation also supports an estimated 30,000 feral horses that contribute to and cause overgrazing problems (Navajo Times 2012). Attempts to control the feral horse population continue to be an ongoing issue on the Navajo Nation.

Livestock grazing is managed by the District Grazing Committees, Farm Boards, and Eastern Navajo Land Board members. Oversight and technical assistance is provided by the Grazing Management Office under the Navajo Nation Department of Agriculture. In general, grazing permits are authorized year round on the west side of the Navajo Nation, while the Eastern Navajo authorizes seasonal permits for the mountainous areas (Hazelton 2012c, pers. comm.). Grazing permits are held by individuals for a certain number of animal units. The grazing permits are generally considered permanent and are inherited by the spouse or children within a family. Livestock rotation is at the discretion of the families that own the livestock.

All areas occupied by the Fickeisen plains cactus on the Navajo Nation are potentially subjected to impacts associated with this grazing (NNHP 2011a, p. 1). However, monitoring has not been conducted in such a way to assess the overall impacts of grazing to the Fickeisen plains cactus and its habitat. Notes from the Navajo Nation Heritage Program pertaining to the 15 known Fickeisen plains cactus populations indicate some livestock impacts have been observed within the 3 largest populations (Hellhole Bend, Salt Trail Canyon, and Blue Spring) (NNHP 2011a, p. 4). A 2012 site visit to the Hellhole Bend population observed habitat disturbance by feral horses and sheep, but no impacts to plants were observed (Robertson 2012, p. 1). Some of the native vegetation within occupied habitat appeared to have been heavily grazed, likely attributable to animals seeking forage following a dry winter.

Livestock damage by sheep was observed at the Salt Trail Canyon population in 2005 (Roth 2007, p. 2) and again in 2008, with nine livestock-related mortalities. Roth (2008, p. 2) documented six dead plants located within a depression in the ground that was believed to have been dug by sheep that bedded down on top of the plants. Monitoring of the plot in 2011 found some evidence that the plot had been disturbed by animals (i.e., one plant appeared to have been partly eaten) and may have contributed to the high mortality that year (NNHP 2011b, p. 4). An October 2011 site visit by the Service observed the habitat had been disturbed by feral horses and sheep concentrating in the area. We do not know at this time how frequent or how long this site may be used by livestock. The only other available information documented hoof prints of cattle and sheep near a cluster of the Fickeisen plains cactus at Shinumo Altar in 1991; one cactus had been partially uprooted and was lying in a hoof print (NNHP 1994, p. 5).

Kaibab National Forest Lands—On the North Kaibab Ranger District, the Fickeisen plains cactus occurs in the Slide Pasture of the Central Winter Allotment that is also part of the Kane Ranch. The Slide Pasture has not been grazed since 2002 (Phillips 2012, p. 1). In addition, the Central Winter Allotment was closed to grazing from 1996 to 2001 due to the 21,448-ha (53,000-ac) Bridger-Knoll wildfire. The habitat type within 3.2 km (2 mi) of the Fickeisen plains cactus population is not suitable for livestock; there are occasional sagebrush, but no understory grasses. A 2011 Kane Ranch Environmental Assessment is currently in process that would address the impacts of livestock grazing to the Fickeisen plains cactus. Populations on the eastern side of the forest boundary are within the Grand Canyon National Game Preserve, which has no livestock grazing.

State and Private Lands—The Cataract Ranch has been utilized for

livestock grazing for well over 100 years. Livestock grazing, by cattle and horses, occurs within occupied Fickeisen plains cactus habitat but is managed differently than grazing on the BLM and Navajo Nation and is not comparable. While the cattle operations are vital to the Cataract Ranch, livestock grazing is managed in a manner that is consistent with the philosophies, values, and conservation ethic of the Babbitt Ranches. For example, cattle operations are one component of the Cataract Ranch, but the Ranch and the other Babbitt Ranches are managed in a holistic manner that incorporates ecology (wildlife habitat, vegetation diversity, watershed health, historical preservation, cultural values, and recreation), the local and regional economies, and the local and regional human community (Babbitt Ranches 2012, entire). Therefore, herd sizes are not adjusted in response to seasonal availability of water and forage due to drought but are managed together with rangeland health, watershed, and wildlife habitat. More specific to the Fickeisen plains cactus, Goodwin (2011a, p. 8) noted no habitat impacts from grazing in this population while conducting searches for the plant from 2006–2011. Additionally, a land assessment by TNC determined that much of Cataract Ranch remains in an undisturbed, natural state (TNC 2000, p. 1), and the general ecological conditions of the land are excellent (TNC 2011, p. 9). While the Fickeisen plains cactus remains vulnerable to being stepped on by cattle or horses, we anticipate that livestock grazing would not rise to a population-level threat based on habitat conditions. We, therefore, do not anticipate livestock grazing on the Cataract Ranch to be a threat to the Fickeisen plains cactus and its habitat.

In summary, all habitat for the Fickeisen plains cactus occurs in areas that have been grazed and will continue to be grazed in the future. Heavy grazing has been documented on approximately 40 percent of its range, including the Arizona Strip and Navajo Nations lands, with the latter being largely unregulated grazing management. Although current grazing pressures across the range of the Fickeisen plains cactus are far below the levels of the late 1800s, the continued presence of Fickeisen plains cactus does not suggest grazing has no effect on the plant. Based on available information, the rangelands are still recovering from past heavy grazing across the range of the Fickeisen plains cactus. Continued grazing on the BLM and Navajo Nation during the prolonged drought in the late 1990s and local droughts in the 2000s has added to rangeland deterioration and changes to the vegetation community, while the drier climate is compounding recovery of the grasslands that support habitat for the Fickeisen plains cactus.

Long-term monitoring has documented direct mortality to the Fickeisen plains cactus from livestock. More plants on the BLM lands have likely been killed or damaged from trampling, especially given evidence of trampling on other *Pediocactus* species, but for which the effects are not captured during the monitoring period. Trampling has removed adult individuals from the population. While this occurs infrequently and affects a few plants, it contributes to population declines and may exacerbate the effects of small population size (see *Factor E. Other Natural or Manmade Factors Affecting Its Continued Existence* section). Thus, livestock grazing, in and of itself, may not rise to a population-level threat for the Fickeisen plains cactus, but when combined with additional stressors such as nonnative species, drought, and climate change, rodent and rabbit predation (discussed below), the combined effect will likely produce population-level impacts to the Fickeisen plains cactus. Therefore, we believe that livestock grazing, in conjunction with other factors, is a threat to the Fickeisen plains cactus and its habitat.

Nonnative, Invasive Plant Species

A potential threat to the Fickeisen plains cactus and its habitat is nonnative, invasive species. The spread of nonnative, invasive species is considered the second largest threat to imperiled plants in the United States (Wilcove *et al.* 1998, p. 608). Invasive plants—specifically exotic annuals—negatively affect native vegetation, including rare plants. One of the most substantial effects is the change in vegetation fuel properties that, in turn, alter fire frequency, intensity, extent, type, and seasonality (Menakis *et al.* 2003, pp. 282–283; Brooks *et al.* 2004, p. 677; McKenzie *et al.* 2004, p. 898). Shortened fire return intervals make it difficult for native plants to reestablish or compete with invasive plants (D'Antonio and Vitousek 1992, p. 73).

Invasive plants can exclude native plants and alter pollinator behaviors (D'Antonio and Vitousek 1992, pp. 74–75; DiTomaso 2000, p. 257; Traveset and Richardson 2006, pp. 211–213; Cane 2011, pp. 27–28). For example, cheatgrass and red brome outcompete native species for soil nutrients and water (Aguirre and Johnson 1991, pp. 352–353; Brooks 2000, p. 92), as well as modify the activity of pollinators through producing different nectar from native species (Levine *et al.* 2003, p. 776) or introducing nonnative pollinators (Traveset and Richardson 2006, pp. 208–209). Introduction of nonnative pollinators or production of different nectar can lead to disruption of normal pollinator interactions for the Fickeisen plains cactus.

Within the range of the Fickeisen plains cactus habitat, the BLM identified 15 nonnative, invasive species: 9 that are designated as noxious weeds in Arizona and 6 nonnative species that are not listed as noxious weeds on the Arizona Strip (BLM 2007a, pp. 3–34). The Cataract Ranch identified 26 nonnative, invasive species on their land. Some of these species are the same species that are also found on the BLM (Goodwin 2011a, p. 11). Those nonnative, invasive species that are common to both landowners include *Acroptilon repens* (Russian knapweed), *Alhagi maurorum* (camelthorn), *Bromus tectorum* (cheatgrass), *B. rubens* (red brome), *Halogeton glomeratus* (halogeton), *Salsola tragus* (Russian thistle), and *Taeniatherum caput-medusae* (medusahead). In addition, Roth (2007, p. 2) documented *Erodium cicutarium* (redstem filaree) within Fickeisen plains cactus habitat on the Navajo Nation.

On the Arizona Strip, we have some information on the distribution of nonnative, invasive species relative to the Fickeisen plains cactus. Generally, the majority of nonnatives occur near areas between Mainstreet Valley and just east of Hurricane Cliffs (BLM 2007a, Figure 3–12), where Fickeisen plains cactus populations are scattered. During a site visit in 2011, Russian thistle was identified in the Dutchman Draw plot, but any negative effects the species may have on the plant have not been documented by the BLM. Cheatgrass, at varying levels of abundance, is found on the Kane Ranch in House Rock Valley. Based on preliminary modeling results that predict the probability of cheatgrass occurrence, the probability of cheatgrass occurrence appears to be low within in the vicinity of the Fickeisen plains cactus at North Canyon wash, although cheatgrass is present within proximity to the canyon rims.

On the Kaibab National Forest, cheatgrass is the only nonnative, invasive species known to exist in the Fickeisen plains cactus habitat (USFS 2005, p. 139). According to the Forest, cheatgrass occurs in very low densities and is not expected to increase due to lack of available substrate and minimal habitat disturbance. However, the GCT, through their modeling, identified a

high probability of cheatgrass occurrence just south of occupied Fickeisen plains cactus habitat (GCT 2011). If this patch is ignited by a lightning strike, there is the potential for cheatgrass to carry a fire into the area where the Fickeisen plains cactus occurs. Another concern would be if a high density patch of cheatgrass were ignited but the fire stops short of Fickeisen plains cactus habitat, the areas burned could facilitate the spread of cheatgrass towards occupied Fickeisen plains cactus habitat, where the cactus could potentially decrease in density and cheatgrass become a prolific competitor.

On the Navajo Nation, the presence of invasive, annual grasses may have contributed to the decline of the Fickeisen plains cactus within the Salt Trail Canyon (Roth 2007, p. 2). During high rainfall years, high densities of red brome and redstem filaree have dominated the habitat in the Salt Trail Canyon monitoring site (Roth 2008, p. 4). Roth (2005, p. 1) observed an overall decline in the Fickeisen plains cactus population at that time, finding more numbers of the Fickeisen plains cacti in areas where fewer exotic grasses occurred. Red brome is known to deplete soil water faster and at greater depths than native annual species (Brooks 2009, p. 118), and can germinate before native annuals in years with low precipitation and earlier in the season (Salo 2004, p. 293). Higher densities of red brome may also reduce the germination of native plant species (Brooks and Esque 2000, p. 40). Red brome is an early flowering, winter annual species that utilizes winter precipitation (Rice *et al.* 1992, pp. 32, 38; Salo 2004, p. 291). Fickeisen plains cactus is also a species that germinates early in the spring, and, although no studies have investigated the relationship of nonnative, invasive annuals on the seed germination of the plant (Roth 2008, p. 4), the occurrence of red brome and redstem filaree are likely to result in competition for resources the Fickeisen plains cactus depends on.

Cheatgrass and red brome can increase in abundance after a wildfire and increase the chance for more frequent fires (D'Antonio and Vitousek 1992, pp. 74–75; Brooks 2000, p. 92; Brooks and Pyke 2001, p. 5). In addition, cheatgrass invades areas in response to surface disturbances (Hobbs and Huenneke 1992, pp. 324–325, 329, 330). Cheatgrass and red brome are likely to increase due to climate change (see ''Drought and Climate Change'' discussion, below) because nonnative, invasive annuals increase biomass and seed production at elevated levels of carbon dioxide (Smith *et al.* 2000, pp. 80–81; Ziska *et al.* 2005, p. 1328).

The Fickeisen plains cactus has likely evolved adaptions to low intensity, frequent grass fires but may not survive high intensity fires even at low fire return intervals. Some of the Fickeisen plains cacti populations occur on ledges and in areas with sparse vegetation away from annual grasses and would likely not be impacted. However, there are some populations, such as Dutchman Draw, Sunshine Ridge, and the Salt Trail Canyon, where invasive, annual grasses could facilitate the spread of fire into occupied habitat and impact the population. It is difficult to know for certain if cheatgrass could affect the Fickeisen plains cactus or its habitat on the Kaibab National Forest. With the probability of high densities of the species surrounding the plant, the potential for negative impacts does exist. In other species of *Pediocactus,* monitoring of the *Pediocactus paradinei* (Kaibab plains cactus) exposed to different fire intensities indicated high intensity fires resulted in plant mortality (Warren *et al.* 1992, abstract). There is also evidence suggesting that invasion and dominance of cheatgrass following a past fire may have contributed to the decline or loss of some Kaibab plains cactus in the House Rock Valley (USFS 2007, p. 47), suggesting that fire could impact the Fickeisen plains cactus in a similar manner. At this time, however, we do not have sufficient information to evaluate whether the presence of nonnative, invasive species would facilitate the spread of wildfires into Fickeisen plains cactus habitat.

In summary, nonnative, invasive species such as cheatgrass, red brome, and redstem filaree grow rapidly and are prolific seed producers in wet years. Although we lack site-specific information on where nonnative, invasive species occur, we do know they occur in varying densities within or near the Fickeisen plains cactus. Invasion of these species may contribute to the low recruitment of the Fickeisen plains cactus by inhibiting seedling germination due to competition and increasing the plant's risk of exposure to high intensity fires. Densities of the nonnative, invasive species may increase due to climate change (see ''Drought and Climate Change'' section, below) because invasive annuals increase biomass and seed production at elevated levels of carbon dioxide (Brooks and Pyke 2001, p. 42; Bradley 2009, p. 203). Based on available information, we anticipate that densities of nonnative, invasive species will increase in the future. Therefore, we consider nonnative, invasive species to be a threat to the Fickeisen plains cactus.

Uranium Mining

High-quality uranium ore deposits are found on the Arizona Strip and on the Coconino Plateau. Interest in the region's uranium deposits increased in 2008, as the price for uranium ore rose, and applications for new mining claims were sought on public lands surrounding the Grand Canyon. In response, the Secretary of the Interior signed Public Land Order Number 7787 (PLO 7787) effectively withdrawing 407,335 ha (1,006,545 ac) of Federal mineral estates within three parcels from any individual or company making a new mining claim under the Mining Law of 1872 (30 U.S.C. 22 *et seq.*) for a 20-year period (BLM 2012a, pp. 1–4). Existing locatable mineral operations in the withdrawal area will continue to be managed under the current Federal land agency regulations.

However, notices of intent or plans of operations submitted after the effective date of the withdrawal for mineral exploration or development on BLM and the National Forest System lands on claims pre-dating the withdrawal would not be able to proceed unless the mining claim was determined to be valid under the Mining Law of 1872 as of the date of the segregation from new mining claims (July 21, 2009). Sampling may still occur on claims pre-dating the withdrawal to support the mineral examination. In the event the claims are determined to be valid, mining activities could occur at some point in the future (BLM 2011a, 2–14).

There are three Fickeisen plains cactus populations in two parcels of the withdrawal area boundary. The Sunshine Ridge population is in the North parcel; the North Canyon wash and the Kaibab National Forest populations are in the East parcel (BLM 2011a, Figure 3–8.1). The mineral withdrawal essentially removed the potential for negative effects on the Fickeisen plains cactus and its habitat that would be associated with the location and development of new mining claims for the longevity of PLO 7787. Although, if the development of existing valid mining claims in the East parcel were to proceed, we anticipate that the potential for adverse effects from the mine on the North Canyon wash population would be low. This is primarily due to plants growing on ledges and along the rim of the wash, where mineral activity would not likely occur. We also anticipate this low impact scenario to be likely for the

Kaibab National Forest population due to its proximate location near canyon rims.

On the North Parcel, there are six mines surrounding the Sunshine Ridge population (BLM 2011a, Figure 2.4–2). Two mines (Hack Canyon and Hermit mines) are located in close proximity to the Sunshine Ridge population but are currently in reclamation status and no impacts to the population are anticipated. Three mines (Arizona 1, Kanab North, and Pinenut) have an approved plan of operation and pre-date the withdrawal. All three are located well outside of occupied Fickeisen plains cactus habitat. The Arizona 1 mine has been operating since late 2009 (BLM 2012b, p. 6), and no impacts to the plants have been documented by the BLM. The Pinenut mine is scheduled to begin operations in 2012 (McKernan 2012, pers. comm.), but due to its distance from the Sunshine Ridge population, no impacts are anticipated. The Kanab North mine is operating under interim management (e.g., standby status) and will begin reclamation activities in the summer of 2012. The sixth mine, EZ Mine, is located to the west of the population and proposed for development. The potential direct and indirect effects to the Fickeisen plains cactus would be the loss, removal, or injury of plants and loss of habitat from the development of the mine but also habitat degradation or fragmentation from road construction, material transport, and new power lines (Payne *et al.* 2010, pp. 8–9; BLM 2011a, p. 2–15). The BLM, however, will complete a project-specific environmental analysis in the near future that addresses site-specific analysis, findings, and decisions regarding the EZ Mine, and what plan of operations will be made (BLM 2011a, pp. 2–29–2–30). We anticipate the opportunity to work with BLM and address any potential negative impacts from this mine on the Fickeisen plains cactus at that time. In addition, the North Parcel has seven breccia pipes that are confirmed to have uranium resources, and those uranium resources have been estimated (BLM 2011a, pp. 3–35–3–36; BLM 2012b, p. 7). Any mining claim containing these seven breccia pipes would be able to demonstrate valid existing rights and would be mined. If one of the claims were to be developed into a mine, the BLM would take measures to minimize impacts to the Fickeisen plains cactus, such as conducting preconstruction surveys to flag avoidance areas and minimize impacts to the species (BLM 2007b, pp. 74–76).

Lands on the Arizona Strip that are outside of the withdrawal area boundary are open to uranium mineral development (BLM 2008a, pp. 1–20). Because the Fickeisen plains cactus occurs in small, isolated areas on particular soil types, small disturbances to the vegetation and soils may reduce suitable habitat; increase the erosion potential; enable invasion of nonnative, invasive plants; and increase the risk of mortality from clearing, crushing, or trampling associated with developing mining sites (Service 2007a, p. 90; BLM 2011a, p. 4–154). The BLM anticipates a very low likelihood that any such project would be proposed within the habitat of the Fickeisen plains cactus. If such a project is proposed, the BLM would take measures to minimize impacts to the Fickeisen plains cactus as described above (BLM 2007b, pp. 74–76).

On the Coconino Plateau, just south of the Grand Canyon National Park, there is a continued interest in uranium mining on State land. The company VANE Minerals holds mineral rights (or mineral interest to mine uranium) on a large number of properties that are spread over an area of approximately 16,187 sq km (6,250 sq mi) (VANE Minerals 2012) and that include occupied Fickeisen plains cactus habitat on State land within the Cataract Ranch. The company has completed surface drilling for their Wate Uranium Breccia Pipe—located 9 miles south of the Grand Canyon National Park and near the Hualapai Indian Reservation. The company is pursuing a mineral lease from the Arizona State Land Department for ''uranium exploitation'' of the Wate deposit and for preliminary efforts regarding development of the mine. No Fickeisen plains cactus has been documented in this general area, and therefore the plant would not be affected by development of a mine. Exploration drilling has been conducted for twelve additional uranium mineralized breccia pipes that are located within 32 km (20 mi) of the Wate deposit (SRK Consulting 2011, p. 14–1). No mineral resources for these have been established as of 2011, but if a uranium resource is confirmed, a potential exists for a mine to be developed. If that occurs and depending on location information, there is a potential for construction and operations to impact the Fickeisen plains cactus on State land within Cataract Ranch. Direct and indirect impacts would be the same as those identified for the Sunshine Ridge population. However, any development, including mining and associated roads from State land that would need to cross onto land in the Cataract Natural Reserve Land, would be prohibited. Additionally, the location of some Fickeisen plains cacti growing near the rim of Cataract Canyon may be protected from development activities, but those located 4.8 km (3 mi) from the rim could potentially be impacted. Loss of individual plants would lead to declines in the Cataract Ranch population, which is currently the largest known population, and hinder the ability of the Fickeisen plains cactus to increase its distribution in this area. It would also contribute to the further decline of the rangewide population.

In summary, PLO 7787 effectively withdrew over 407,335 ha (1,006,545 ac) of federal mineral estates for a 20-year period; this action removes the immediate threat of habitat loss or degradation associated with development of new uranium mines to the Fickeisen plains cactus populations in House Rock Valley, in the Kaibab National Forest, and on Sunshine Ridge. We acknowledge the possibilities that valid existing mining claims in the withdrawal area boundary could result in the development of a uranium mine in the future. If that happens, we are less concerned with the three populations being adversely affected because of the specific location of the plants near canyon rims. For land on the Arizona Strip that is outside of the withdrawal boundary area, we anticipate a low probability that Fickeisen plains cactus populations would be impacted by future uranium development. If a mine were to be developed near occupied habitat, the BLM would implement avoidance measures to reduce or minimize impacts to the Fickeisen plains cactus, which we anticipate would be incorporated into their analyses for the development of the EZ Mine. On State land, the potential for uranium mining could result in direct mortality and loss of habitat within the Cataract Ranch population. However, most plants are located in close proximity to the rim of Cataract Canyon and would not likely be affected by mining construction or operations. Additional protection to the plant is provided through the terms of the conservation easement, which prohibits new development, including mining, on those parcels, thus preventing new roads or right-of-ways from State lands crossing onto private lands. Therefore, based on available information, we do not anticipate that development of a uranium mine would rise to the level of significance and meaningfully impact the Fickeisen

plains cactus and its habitat. Thus, we conclude that uranium mining is not a threat to the Fickeisen plains cactus or its habitat.

Road Construction and Road Maintenance

Roads can destroy or modify habitat and increase human access that may lead to trampling (discussed below). Additionally, road construction can lead to increased erosion, and vehicle traffic on unimproved roads can result in increased atmospheric dust and dust deposition on vegetation. Road maintenance on U.S. Highway 64 near the Navajo Nation resulted in three Fickeisen plains cacti being salvaged from the existing right-of-way and a fourth cactus protected by fencing (Arizona Department of Transportation 1992, p. 1). Road maintenance also contributed to an unknown amount of habitat loss or disturbance, which was likely small in size.

We analyzed road maintenance and considered it a potential threat to the Fickeisen plains cactus in the November 9, 2009, Candidate Notice of Review (74 FR 57804). On the Arizona Strip, the Fickeisen plains cactus occurs next to roads that receive routine maintenance. The cactus grows close to and, in some cases, in the middle of existing unpaved but well-maintained roads, making it highly vulnerable to becoming crushed or injured by motorized vehicles. Road maintenance activities had resulted in the mortality of a few individuals of the Fickeisen plains cactus on BLM land. These appear to have been isolated occurrences that happen infrequently and impacted a small number of individual plants. Future road construction associated with both uranium and urban development may impact plants that occur on non-BLM lands. However, future road construction is anticipated to be localized in time and space, and would not rise to the level of becoming a significant threat to the Fickeisen plains cactus. Therefore, we do not consider road construction and road maintenance to be a threat to the Fickeisen plains cactus.

Off-Road Vehicle Use and Recreation

Off-road vehicles are a means of transportation and a form of recreation in the range of the Fickeisen plains cactus. On the Arizona Strip, the BLM limits motorized and mechanized vehicle use within Fickeisen plains cactus habitat to existing routes and trails. However, motorized vehicles may pull off a designated route up to 30.5 m (100 ft) on either side of the centerline to camp. There is the potential for vehicles to injure or kill a Fickeisen plains cactus and impact its habitat by pulling off the roadway to park or turn around (BLM 2007b, p. 75). Plants growing along the Navajo Trail near Mainstreet Valley have been affected by drivers pulling off designated routes in the past (Hughes 2005, pers. comm.). Disturbance from ORV use associated with unauthorized camping was documented in House Rock Valley, where a driver drove off-road towards the canyon rim near the South Canyon population (Service 2007b, p. 1). These are the two documented reports that we have of the Fickeisen plains cactus being impacted by ORV use on BLM lands since 2005. In reviewing the BLM's monitoring reports, there were no documented mortalities associated with ORV use to the Fickeisen plains cactus over the 23 years the plant was monitored.

Most of the Fickeisen plains cactus habitat on the Navajo Nation is accessible by dirt two-track roads. Although traffic in these areas is light, and there is an extensive network of existing dirt roads, new roads are continually being created, presumably by locals herding livestock (NNHP 2011a, p.1). No plants have reportedly been impacted, but there is potential for habitat degradation as a result. In addition, 9 of the known 15 populations are located along the scenic canyon rims of Marble Canyon and the Little Colorado River gorge, where tourist traffic is concentrated. Car tires and foot traffic have been documented as damaging the Fickeisen plains cactus at some of these sites (NNHP 1994, p. 5; NNHP 2011a, p. 1). These impacts are likely to increase in the future as there are future plans to develop tourist activities on Navajo land near Marble Canyon and the Little Colorado River gorge (NNHP 2011a, p. 1).

On the Cataract Ranch, increased recreation, primarily associated with hunting, has been observed since 2006. Hunting relies on the use of ORV to retrieve wildlife and access camp sites. However, no impacts to the Fickeisen plains cactus related to recreational activities or ORV use have been observed while conducting searches for the plant on the Cataract Ranch (Goodwin 2011a, p. 8).

In summary, the habitat of the Fickeisen plains cactus is mostly open with flat topography. With most plants growing along scenic canyon rims, there is an increased risk of plants being destroyed or damaged by vehicles driving off-road for recreational purposes. We identified ORV use as a potential threat to the Fickeisen plains cactus in our annual assessment for candidate species (most recently at 75 FR 69222, November 10, 2012). At this time, however, we cannot quantify the extent of ORV-use impacts on the taxon or its habitat, but they continue at some unknown level. Most documented occurrences happened in the past and were isolated occurrences. ORV use may become a threat to the Fickeisen plains cactus in the future but at this time, we do not consider it to be a threat to the plant or its habitat.

Commercial Development

The Navajo Nation is currently interested in developing its land along the canyon rims of Marble Canyon and the Little Colorado River gorge to increase tourism and create more jobs that would boost their local economy (NNHP 2011a, p. 1; Navajo-Hopi Observer 2012). The Navajo Nation President recently signed a nonbinding agreement with a local Arizona developer that lists a resort hotel and spa, restaurant, half-mile river walk, and recreational vehicle park among the attractions that would enable tourists to easily descend into the Grand Canyon. While we do not have specific information about these plans, development along the rim of the Little Colorado River has the potential to impact the Salt Trail Canyon population located nearby. Trampling of plants by people and loss of plants and habitat to make way for development are both of concern. Available information suggests that plans for the proposed development have not begun (NNHP 2011a, p. 1) and may still be in the early design phase.

The Salt Trail Canyon is a known recreational site located to the north of the Fickeisen plains cactus population. Aside from use by hikers, the area is used by Federal and State agencies as a point of entry to conduct native fish surveys in the Little Colorado River. Overall use of the area appears to be minimal, and no recreational impacts to the Fickeisen plains cactus have been observed.

A popular tourist destination that has existed for many years occurs within the Fickeisen plains cactus population that is adjacent to a Little Colorado River overlook. This population was last visited in 1997, and contained 15 plants distributed among two ridges (NNHP 2011a, p. 4). Abundant foot traffic within occupied habitat was identified as a threat to the population by the Navajo Nation Heritage Program. Although the tourism at this site will continue in the future, most foot traffic is confined to paved sidewalks leading towards the canyon rim and outside of occupied habitat. An additional population occurs east of the overlook

area that is also well known among plant enthusiasts and, as a consequence, frequently visited (NNHP 1994, p. 5). This population was last visited in 1999, and one individual was located (Table 3). The timing of the visit was outside of the flowering season, making it difficult to locate plants (NNHP 2011a, p. 4). Both of these areas are easily accessible from the highway and receive a large number of visitors. Trampling of plants and habitat disturbance associated with tourism may increase in the future simply due to the popularity of this site and the accessibility of plants next to the highway. Although habitat disturbances to the Fickeisen plains cactus have occurred here in the past and may be occurring presently, we have no information to be able to quantify this threat.

There is also a potential for human development to expand into or next to the Fickeisen plains cactus habitat on the Navajo Nation. A land dispute between the Navajo and Hopi Tribes resulted in the implementation of a construction ban in 1966 that limited development (Maxx 2012, p. 2). That ban was lifted in 2009, but no development has occurred due to the poor economy. The land has remained mostly undeveloped, but the ability to construct new homes or make improvements provides Tribal members access to areas previously restricted. If this occurs, we do not anticipate the Fickeisen plains cactus to be significantly impacted because new home locations would not be near the canyon rim where the plant occurs. Additionally, the Fickeisen plains cactus is listed as a Group 3 species on the Navajo Endangered Species List, which is a ''species or subspecies whose prospects of survival or recruitment are likely to be in jeopardy in the foreseeable future'' (Navajo Nation Division of Natural Resources 2008, entire). Its listed status on tribal land, in addition to the location of the Salt Trail Canyon population within an area designated as a Preserve, would likely reduce or minimize impacts to the population (see *Factor D. The Inadequacy of Existing Regulatory Mechanisms,* below).

In summary, commercial development associated with tourism activities has impacted the Fickeisen plains cactus' habitat. Impacts to occupied habitat near the Little Colorado River overlook were documented in the past and are ongoing. This population is small and would benefit from a current site visit. Plans for future commercial development near Marble Canyon and the Little Colorado River gorge may substantially impact the Salt Trail Canyon population through potential habitat loss or disturbance. The Salt Trail Canyon population is one of the larger populations on the Navajo Nation and rangewide. Losses to this population would result in further declines to the rangewide population. However, the protected status of the Fickeisen plains cactus and its occurrence within a designated Preserve would to minimize or reduce potential impacts from future commercial development. In addition, we do not have any information to indicate whether plans to develop commercial properties will occur in the future. Therefore, the threat of commercial development is not impending, and we do not consider this a threat at this time or within the near future.

Drought and Climate Change

For background information, please refer to the first paragraph of the ''Drought and Climate Change'' discussion under *Factor A. The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range* in the *Summary of Factors Affecting the Acuña Cactus.* As previously discussed, the Fickeisen plains cactus is an endemic species with localized, small populations. In addition, these populations are restricted to very specific soil types. Global climate change exacerbates the risk of extinction for species that are already vulnerable due to low population numbers and restricted habitat requirements. Predicted changes in climatic conditions include increases in temperature, decreases in rainfall, and increases in atmospheric carbon dioxide in the American Southwest (Easterling *et al.* 2000, pp. 2072–2073; IPCC 2007, p. 48; Archer and Predick 2008, pp. 23–24; Karl *et al.* 2009, p. 129). Although we have no information on how the Fickeisen plains cactus will respond to effects related to climate change, persistent or prolonged drought conditions are likely to reduce the frequency and duration of flowering and germination events; lower the recruitment of individual plants; compromise the viability of populations; and impact pollinator availability, as pollinators have been documented to become locally extinct during periods of drought (Memmott *et al.* 2007, pp. 713–715). The smallest change in environmental factors, especially precipitation, plays a decisive role in plant survival in arid regions (Jordan and Nobel 1981, pp. 904–905; Nobel 1984, pp. 310, 316).

In the last 30 years, the Colorado Plateau has experienced a 0.2 to 0.5 °C (32.36 to 32.9 °F) increase in average temperature, particularly in average fall-winter temperatures. Future climate projections forecast increases in both the average and extreme temperatures that are expected to result in less available soil moisture for plants (Schwinning *et al.* 2008, p. 14). In addition, the Colorado Plateau may be shifting towards a climate of reduced winter precipitation over the next 20 to 30 years. Winter accumulation, which recharges the soil moisture needed for spring vegetative growth, was below average in 11 years from 1996 to 2007. Similarly, spring precipitation was below average in 8 years from 1996 to 2006 (Hereford 2007, p. 6). By 2090, precipitation is predicted to decline by as much as 5 percent across the Colorado Plateau, placing greater stress on native plants and resulting in a greater susceptibility of existing ecosystems to be replaced by nonnative, invasive plant species (BLM 2011b, entire).

The Fickeisen plains cactus is adapted to the semi-arid climate of the Colorado Plateau by retracting underground in response to dry and cold climatic conditions. Weather patterns, timing of precipitation, and cool nighttime lows influence germination and seedling establishment of the Fickeisen plains cactus (Brack 2012, pers. comm.). If climate patterns move towards more aridity, the reproductive output of the Fickeisen plains cactus may be reduced. Increases in summer temperatures may lead to longer periods of time that the plant remains retracted underground, and temperatures may rise to a level that is beyond the plants' natural threshold for survival. Studies on cacti seedling survival have shown that seedlings are able to survive long periods of drought when they are larger and have the capacity to store enough water to endure their first dry season (Nobel 1984, p. 316). Seedlings of the Fickeisen plains cactus have been observed under mature plants, which act as nurse plants; the shading provided by a parent or nurse rock may increase their survival (NNHP 1994, p. 4). Increases in soil temperatures, coupled with below-average precipitation, may increase seedling mortality.

A study published in 2012 modeled the species' distribution of endemic plants on the Colorado Plateau (Krause and Pennington 2012, entire). It identified limiting factors that define the habitat needs of the species and the top-five predictor variables that influence their distribution. In level of

importance, the model included the Fickeisen plains cactus' and ranked the minimum temperature of the coldest month second, precipitation of driest quarter third, and isothermality fourth in predicting Fickeisen plains cactus distribution (Krause and Pennington 2012, p. 140). Of emphasis was the variable isothermality, the mean day-to-night temperature range compared to the annual temperature range, in predicting endemism on the Colorado Plateau. As nighttime lows during the winter season are predicted to increase, isothermality or the reduction in daily temperature variance may hinder seedling germination for the Fickeisen plains cactus for reasons discussed above.

On BLM lands, observed trend information from the four monitoring plots appear to correlate with changes in climate patterns. Increases in plant numbers and observed seedlings were documented between 1986 and roughly 1992. These years were characterized as a wet period where the annual precipitation was above the regional median on the Colorado Plateau (USGS 2002, p. 2). After 1992 through approximately 2005, when the region experienced a prolonged drought, the Fickeisen plains cactus among the plots experienced variable decreases in plant numbers. Monitoring of the Fickeisen plains cactus during years with below-average precipitation documented low recruitment, increased rodent predation, and an increase in the number of plants retracted or missing (Hughes 1988, p. 1; Hughes 1996c, p. 1; Roaque 2012, pers. comm.). In total, 817 plants were recorded as missing or retracted over the 13 years when this parameter was recorded. The years with the highest number of missing plants were from 1999 to 2007, the time period that corresponds to the drought in the Southwest. We do not believe all 817 missing plants are attributed solely to drought, but drought is likely a significant contributing factor to the observed decline in the populations.

The Navajo Nation is in one of these driest areas in the State. About 45 percent of all annual precipitation occurs during the warmer months of July through September. Climate data are variable on the reservation, but long-term information shows a drying trend has occurred since 1944, and a warming trend has occurred since the mid-1970s (Navajo Times 2011). The drought in the Four Corners region was officially recorded from 1999 to 2009, although many residents believe it began in 1996, which would make it the longest drought in Navajo history. The effects of the last drought have been particularly extreme on the population. For example, from 2001 to 2002, Navajo officials reported 30,000 cattle mortalities from lack of water and forage. Many traditional people on the reservation live in subsistence lifestyles. Over half of the population lives without indoor plumbing and are dependent on hauling water. Their water supplies are derived from shallow aquifers and are sensitive to dry conditions. When availability is low, families often use water supplies intended for livestock (Redsteer *et al.* 2010, p. 2).

In interviews with 50 tribal elders, Redsteer *et al.* (2010, p. 7) summarized the most common observations regarding drought: (1) Long-term decreases in the amount of annual snowfall over the past century; (2) decline in surface water features and water availability; (3) disappearance of springs and of plant and animal populations; and (4) changes in the frequency of wind, sand, and dust storms. These have been corroborated with other findings. Weiss *et al.* (2009, p. 5923) found that a significant increase in evapotranspiration occurred during the warmer months of the 2000s drought due to higher temperatures. It is likely that above-average spring temperatures are linked to a decrease in the amount of new growth among plants. It has been suggested that warmer spring temperatures lead to early germination. Plants respond by ending dormancy and begin using available soil moisture earlier and more quickly in the season. Then, they must survive longer dry periods before the start of the monsoons (Redsteer *et al.* 2010, p. 7).

Seasonal increases in temperature and changes in the timing of precipitation have likely influenced the observed 49 percent decline in the Salt Trail Canyon population. The observed low recruitment, high number of plants missing between years, and mortality can be thus be partly attributed to the drought (NNHP 2011b, pp. 4–5). Corresponding with regional climate patterns, annual precipitation during the monitoring period was below average for each year except for 2007. Winter precipitation was uncommonly high during 2005, the year before the monitoring plots were installed, and in 2010, the year that the plots were not monitored. While several winter storms came through the region, total rainfall accumulation was still below average during the 2011 monitoring period. Many of the plants that could not be located in 2011 were assumed dead because their vigor during previous surveys was rated as ''poor'' in 2009 (NNHP 2011b, p. 3). Some of these plants may have been retracted at the time. However, many plants observed between 2008 and 2011 failed to produce fruit or flower, and fruit buds were observed to be aborted. This suggests low seed production, which would cause that population to decline over time.

In summary, the climate on the Colorado Plateau and Navajo Nation is predicted to become warmer with reduced precipitation in the future. We have strong evidence to suggest that the Fickeisen plains cactus is being impacted by drought coupled with increased annual temperatures. We believe that the high number of dead and missing or retracted plants in all plots monitored is influenced by below-average winter or spring precipitation at the time when plants need soil moisture to flower. Poor reproduction in the Fickeisen plains cactus is likely to worsen in the future if climatic patterns shift towards becoming more arid with increased winter nighttime temperatures. With climatic models predicting future regional droughts, it is likely that all populations of the Fickeisen plains cactus will continue to be affected by drought and climate change. However, it is not clear if drought or climate change, of themselves, present population-level threats of extinction. It appears that drought and climate change in combination with rodent predation (see *Factor C. Disease or Predation,* below), as a combined effect, is the more likely scenario for population-level impacts to the plant. Additionally, the small and declining populations of the Fickeisen plains cactus make the species susceptible to natural environmental variability, including climate conditions. Therefore, based on our review of the available information, we conclude that climate change and drought are threats to the Fickeisen plains cactus populations.

Summary of Factor A

Based on our review of the best available scientific and commercial information, we conclude that fire associated with nonnative, invasive plant species; uranium mining; road construction and road maintenance; ORV use; and commercial development are not threats to the Fickeisen plains cactus and its habitat. We have determined that direct loss of plants and habitat loss and modification due to the direct and indirect effects of livestock grazing; nonnative, invasive plant species; and drought and climate change are threats to the Fickeisen plains cactus. These threats, in and of

themselves, may not result in significant population-level impacts to the Fickeisen plains cactus. However, the above factors appear to be acting synergistically, placing a major stress on the known plants monitored rangewide with little indication of population growth and age-class diversity. The populations for which we do not have reliable and current information on their status are likely in decline. These populations are also being impacted by drought and are also susceptible to the same level of threats as the monitored populations. Thus, the combined effects of each threat elevate the intensity and scope of impacts to the Fickeisen plains cactus and its habitat to where these threats are significant over time. Therefore, based on our review of the available information, we conclude that the present or threatened destruction, modification, or curtailment of the Fickeisen plains cactus habitat or range is a threat to the species.

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

Unauthorized collection is a potential threat for all species of cacti, but it is a specific and definite threat for the genus *Pediocactus.* Their small size, large attractive flower, and rarity make *Pediocactus* species in general highly sought by collectors, growers, or gardens (Benson 1982, p. 243). *Pediocactus* are difficult to grow and maintain in cultivation. As plants grown in backyard gardens die, there is more demand for replacement plants. Unauthorized collection is currently a continuing problem for populations of the threatened *Pediocactus winkleri* (Winkler cactus) in south-central Utah (NPS 2004, p. 1; Borthwick 2012, pers. comm.).

We identified unauthorized collection of the Fickeisen plains cactus as a potential threat in our 2006 Candidate Notice of Review (71 FR 53756) and as a minor threat in our 2010 Species Assessment and Listing Priority Assignment Form. Phillips *et al.* (1982, p. 5) considered the Fickeisen plains cactus to be highly sought after and collected by commercial cactus collectors or hobbyists wherever it was found. For the period 1994 to 1997, the Convention on International Trade in Endangered Species (CITES) annual report documented a total of 5 specimens and 5015 seeds of Fickeisen plains cactus exported (Service 2001a, p. 4). However, we do not know what impact the unauthorized collection had on the Fickeisen plains cactus during that time. We are not aware of any evidence of unauthorized collection of the Fickeisen plains cactus within the last ten years. The BLM and the Navajo Nation have not observed or documented incidences of Fickeisen plains cacti being collected on their lands. In addition, we do not have information from the Arizona Native Plant Division indicating that unauthorized collection of Fickeisen plains cactus from their natural habitat has occurred (Reimer 2012, pers. comm.). Furthermore, apprehension of collectors or enforcement of the law is difficult for *Pediocactus* species considering they occur in remote areas that are not regularly patrolled.

Currently, collection pressure on the Fickeisen plains cactus and demand for plants in the wild appears to be low for several reasons. Over the past 20 years, there has been increased sensitivity towards collection of rare plants from their natural populations among collectors who are satisfied with taking photographs rather than live specimens (Brack 2005, pers. comm.; Brack 2012, pers. comm.). Secondly, the Fickeisen plains cactus has been difficult to grow in cultivation mainly because of its specificity to particular climate conditions (cold winter temperatures) (Brack 2012, pers. comm.). However, more experienced growers have successfully propagated seeds and grown seedlings in captivity. Growers in Europe have successfully gown the Fickeisen plains cactus in cultivation because their climate is similar to that of the Colorado Plateau (Brack 2012, pers. comm.). Currently, the Fickeisen plains cactus is available from commercial vendors who can meet the market demand for this rare plant which has helped alleviate collection pressures. Seeds of the Fickeisen plains cactus are also readily available for sale on the Internet to cactus hobbyists.

In summary, unauthorized collection is a threat for some *Pediocactus* species and a potential threat for the Fickeisen plains cactus. Based on the best available information, we have no evidence suggesting that overutilization of the Fickeisen plains cactus for recreational, scientific, or educational purposes has occurred or is negatively affecting individuals or populations within the species' range. We also have no evidence to suggest that overutilization of the Fickeisen plains cactus will occur in the future to such an extent that the survival of the species would be compromised. Therefore, overutilization for commercial, recreational, scientific, or educational purposes is not considered to be a threat to the Fickeisen plains cactus now, nor do we expect it to be in the future.

Factor C. Disease or Predation

We are aware of a single report of a potential diseased plant in the Shinumo Altar population on the Navajo Nation. In 1991, a mature plant in poor condition was observed to have a large hole through its caudex with orange-red material there. We have no further information regarding disease in other Fickeisen plains cactus populations. Therefore, we do not consider disease to be a threat to the Fickeisen plains cactus.

Rodent and Rabbit Predation

Small mammal herbivory on cactus species is known to occur during dry conditions when animals seek available moisture from the plant or available food from cactus fruit (Butterwick 1987, p. 3; Phillips and Phillips 2004, pp. 14–15; Sivinski and McDonald 2007, p. 104). Because of their small size and spongy spines, the Fickeisen plains cactus may be less protected from animals than other spiny cactus species. Herbivory, primarily by rodents, on the Fickeisen plains cactus has been reported only on BLM lands; however, it likely occurs throughout the range.

The BLM reported a total of 56 plant mortalities associated with rodent predation in the years 1988, 1989, 1990, and 1992. All of the four plots have had reported rodent predation. The greatest losses were reported at Dutchman Draw plot, with 21 plants lost between 1988 and 1990 (Hughes 1988, p. 2; Hughes 1989, p. 2; Hughes 1990, p. 2), and 26 plants at the North Canyon plot in 1992 (Roaque 2012, pers. comm.). Correspondingly, the winter-spring precipitation in 1992 was below average. Small mammal burrows have been observed at the Dutchman Draw, Clayhole Ridge (Robertson 2011, p. 1), and South Canyon (Travis 1987, p. 4) populations. We do not have information about these burrows; however, they may be contributing to the high number of missing or retracted plants within plots. Hughes (1996a, p. 51) believed that heavy cattle grazing may in some part contribute to high incidences of rodent predation through competition for available forage, particularly during periods of drought that, in turn, cause rodents to eat the cactus. While the relationship between drought and rodent predation is less obvious on BLM lands, mortality associated with rodent herbivory on other *Pediocactus* species suggests that the Fickeisen plains cactus is likely being impacted rangewide in a similar fashion.

Monitoring efforts on other *Pediocactus* species reported high rates

of plant mortality associated with rodent herbivory. The BLM found that rodent predation resulted in 81 Brady pincushion cactus mortalities over a 15-year period (BLM 2007b, p. 55). Phillips and Phillips (1995, p. 7) reported 23 Peebles Navajo cactus individuals were lost due to herbivory in 1989, which was attributed to a dry and warmer than normal winter. Sivinski and McDonald (Service 2010, p. 5) identified rabbit and rodent predation as a significant cause of mortality on the *Pediocactus knowltonii* (Knowlton's cactus). They also found that predation rates increase during periods of drought, and no significant germination events had been observed over a 14-year period (Service 2010, p. 12). They infer that low recruitment may be due to high seed predation by rodents in 1993, and they find that seeds of mature fruit are readily eaten by rodents as the fruit ripens, resulting in little seed left to mature.

We acknowledge that small mammal herbivory is natural under drought conditions. While the data are variable for the Fickeisen plains cactus, there is adequate evidence from monitoring studies on this species and other *Pediocactus* species that rodent predation is high in drought years. Climatic conditions throughout the Southwest are predicted to continue to warm with less precipitation in the future as previously discussed. We, therefore, anticipate that rodent or rabbit herbivory may increase in the future as a result of predicted changes in climate. In addition, rodent predation results in the mortality of a large number of individuals, effectively causing population declines in a population that is already small in number. Although we lack clear evidence of the scope of the impact that rodent predation has had on the Fickeisen plains cactus and its seeds, taken in conjunction with other habitat disturbances occurring across its range, low recruitment, and small population size, rodent predation is likely to rise to the level where it becomes a threat to the plant.

Factor D. The Inadequacy of Existing Regulatory Mechanisms

Please refer to the two introductory paragraphs of the Factor D discussion presented above for the acuña cactus. There are no existing laws or regulations in place that address the primary threats to the Fickeisen plains cactus and its habitat from livestock grazing; nonnative, invasive species; rodent predation; drought; or climate change. Those legal and regulatory mechanisms that are in place appear to be adequate to protect the plant.

The Fickeisen plains cactus is listed as a highly safeguarded native plant under the Arizona Native Plant Law (Arizona Revised Statutes, Chapter 7, 2007, entire). Removal of highly safeguarded native plants and their parts is prohibited on public land except by permit. They are also protected from international trade by CITES; however, CITES does not regulate take or domestic trade. While these measures lessen the impact from regulated collection, as described above, there is no indication that an active trade for this plant exists or poses a threat to this plant.

The BLM lists the Fickeisen plains cactus as a sensitive species (BLM 2007a, p. 3–87). As described in the BLM Manual section 6840 (BLM 2008b, pp. 37–38), the BLM will focus sensitive species management on maintaining species' habitat in functional ecosystems, ensuring the species is considered in land management decisions, and prioritizing conservation that emphasizes habitat needs for the species, thereby preventing the need to list the species under the Act. The BLM has the ability to implement conservation measures and best management practices to reduce the threats to the Fickeisen plains cactus from livestock grazing, but we are not aware of any efforts to minimize cattle impacts to the plant or its habitat. In their approved 2008 Resource Management Plan, the BLM designated vegetative habitat areas at Twist Hills and Upper Clayhole Valley for the Fickeisen plains cactus (BLM 2008a, p. 2–41). Management actions that apply to vegetative habitat areas include increased emphasis on protection of the species; increased consideration during National Environmental Policy Act (NEPA; 42 U.S.C. 4321 *et seq.*) analyses; and the ability to modify, mitigate, postpone, or restrict proposed actions to minimize effects to the species. Species-specific conservation measures will apply to management of these and all other areas of occupied and unoccupied habitat for special status species. Because these vegetative habitat areas were recently designated, beneficial effects to the plant and its habitat have yet to be documented.

On the Navajo Nation, the Fickeisen plains cactus is a Group 3 species on the Navajo Endangered Species List. Group 3 species are those ''species or subspecies whose prospects of survival or recruitment are likely to be in jeopardy in the foreseeable future'' (Navajo Nation Division of Natural Resources 2008, entire). Species listed pursuant to the Navajo Nation Tribal Code 17, Subsection 507 are protected by take (17 N.N.C. § 507). In addition to its listed species protection, 9 of the 15 populations are within areas designated as a Preserve, including the three largest populations. No new activity or development is allowed within these Preserves, unless it is compatible with management goals established by the Navajo Nation Department of Fish and Wildlife for that area. Any development project proposed within a Preserve requires a biological evaluation be prepared. The biological evaluation must demonstrate that the development activity is compatible with management goals for the Preserve, as defined by the Navajo Nation Department of Fish and Wildlife Resource Land Use Clearance Policies. These policies are also used by Navajo Nation Department of Fish and Wildlife to ensure that proposed development activity in a Preserve will not negatively affect any listed species, including the Fickeisen plains cactus. It does not, however, apply to daily activities, such as livestock herding and any tourist activities that cannot be easily regulated (e.g., driving and parking at unofficial overlooks) (Hazelton 2012c, pers. comm.). It also does not include approved pre-existing activities.

On the Cataract Ranch, privately owned parcels occupied by the Fickeisen plains cactus are under a conservation easement held by TNC (TNC 2000, entire). These deeded lands prohibit any development activities from occurring on these parcels and protect the inherent value of the land for perpetuity. Daily activities such as livestock grazing and range improvements are permitted. Approximately 29 percent of the known Fickeisen plains cactus population is protected by the conservation easement.

In summary, there are no existing legal or regulatory mechanisms in place to address the primary threats to the Fickeisen plains cactus and its habitat. While the BLM has the ability to provide habitat protection for the Fickeisen plains cactus, any actions would be voluntary under conservation measures aimed to improve the status of sensitive species. The existing legal or regulatory mechanisms that are currently in place do appear to provide adequate protection to the Fickeisen plains cactus and its habitat in the manner they were intended to provide.

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

Small Population Size

The Fickeisen plains cactus is a rare, endemic cactus that is restricted to a particular soil type. Factors such as the small population size, low population density, the isolation of populations between occurrences, and a poor mechanism for seed dispersal renders this cactus vulnerable to extinction from human and natural disturbances. We recognize that this species appears to have always been rare, yet continues to survive, and could be well equipped to continue to exist into the future. Many naturally rare species have persisted for long periods within small geographic areas, and many naturally rare species exhibit traits that allow them to persist despite their small population sizes. Consequently, the fact that a species is rare does not necessarily predispose it to being an endangered or threatened species.

However, this species has shown a marked decline in recent years, and populations across its range do not appear to be recovering. This indicates that there is a heightened risk of extinction, and the contributing factors of ever decreasing population size, coupled with poor seed dispersal, increase the extinction risk. Small populations that are restricted by habitat requirements are more vulnerable to the effects of climate change, such as prolonged droughts and increased fire frequencies. Although small population size and climate change make the species intrinsically more vulnerable, we are uncertain whether they would rise to the level of threat by themselves. However, when combined with the threats from livestock grazing, rodent and rabbit predation, and nonnative, invasive species, small population size likely exacerbates the effects of these threats on the Fickeisen plains cactus.

Proposed Determination for the Fickeisen Plains Cactus

We have carefully assessed the best scientific and commercial information available regarding the past, present, and future threats to the Fickeisen plains cactus. We find that the species is in danger of extinction due to the current and ongoing modification and destruction of its habitat and range (Factor A) from ongoing and future livestock grazing; nonnative, invasive species; and long-term drought. The most significant factors threatening the Fickeisen plains cactus across its range are long-term drought and warmer winters occurring in the past several decades and projected to continue with the effects of climate change. We find that livestock grazing and nonnative species, in combination with drought and climate change, exacerbate the threats to this species (Factor A). We also find predation (Factor C) and other natural or manmade factors are threats to the Fickeisen plains cactus (Factor E). We do not find any threats to the species from unauthorized collection (Factor B). We find no inadequate existing regulatory mechanisms (Factor D).

The Act defines an endangered species as any species that is ''in danger of extinction throughout all or a significant portion of its range'' and a threatened species as any species ''that is likely to become endangered throughout all or a significant portion of its range within the foreseeable future.'' We find that the Fickeisen plains cactus is presently in danger of extinction throughout its entire range based on documented loss of individuals on the majority of its range, little to no recruitment, and continuation of the threats, as described above. Therefore, on the basis of the best available scientific and commercial information, we propose listing the Fickeisen plains cactus as an endangered species in accordance with sections 3(6) and 4(a)(1) of the Act.

The elevated risk of extinction of the Fickeisen plains cactus is a result of the cumulative stressors on the species and its habitat. We have detailed information about population trends from 5 large populations, all of which show a significant decline in overall population, reduction in reproductive adults, little to no seedlings, and low representation of age-class diversity. The decline of these 5 populations is likely indicative of what is occurring in other populations that are smaller, more isolated and not as well studied. Some of these smaller populations have already shown declines in plants numbers; at some sites, plants no longer are found. Information from the 27 populations would increase our knowledge of the species, but it is uncertain if these populations will be monitored in the future due to resource limitations and access to the land. Losses of adult plants in a naturally rare, endemic species exacerbate the species vulnerability to extinction because the older, larger adults contribute more to the population's growth. In the Fickeisen plains cactus, water and heat stress results in reduced flower and seed production, and seedling survival is dependent on winter precipitation and soil moisture. Climate change is anticipated to increase drought periods and warming winters. This combination is expected to continue the documented trend of mortality exceeding recruitment across all populations. All of these factors contribute together to heighten the risk of extinction and lead to our finding that the Fickeisen plains cactus is in danger of extinction, and thus meets the definition of an endangered species.

Listing the Fickeisen plains cactus as a threatened species is not the appropriate determination because the ongoing threats described above are severe enough to create the immediate risk of extinction. The continued loss of reproductive adults without adequate recruitment poses a significant and immediate risk of extinction to the species throughout the species' range, and is not restricted to any particular significant portion of that range. All of these factors combined lead us to conclude that the threat of extinction is high and immediate, thus warranting a determination of endangered species status rather than threatened species status for the Fickeisen plains cactus.

Under the Act and our implementing regulations, a species may warrant listing if it is an endangered species or a threatened species throughout all or a significant portion of its range. The threats to the survival of the species occur throughout the Fickeisen plains cactus' range and are not restricted to any particular significant portion of that range. Accordingly, our assessment and proposed determination applies to the species throughout its entire range.

Available Conservation Measures for the Acuña Cactus and the Fickeisen Plains Cactus

Conservation measures provided to species listed as endangered or threatened under the Act include recognition, recovery actions, requirements for Federal protection, and prohibitions against certain practices. Recognition through listing results in public awareness and conservation by Federal, State, Tribal, and local agencies; private organizations; and individuals. The Act encourages cooperation with the States and requires that recovery actions be carried out for all listed species. The protection required by Federal agencies and the prohibitions against certain activities are discussed, in part, below.

The primary purpose of the Act is the conservation of endangered and threatened species and the ecosystems upon which they depend. The ultimate goal of such conservation efforts is the recovery of these listed species, so that they no longer need the protective measures of the Act. Subsection 4(f) of

the Act requires the Service to develop and implement recovery plans for the conservation of endangered and threatened species. The recovery planning process involves the identification of actions that are necessary to halt or reverse the species' decline by addressing the threats to its survival and recovery. The goal of this process is to restore listed species to a point where they are secure, self-sustaining, and functioning components of their ecosystems.

Recovery planning includes the development of a recovery outline shortly after a species is listed, preparation of a draft and final recovery plan, and revisions to the plan as significant new information becomes available. The recovery outline guides the immediate implementation of urgent recovery actions and describes the process to be used to develop a recovery plan. The recovery plan identifies site-specific management actions that will achieve recovery of the species, measurable criteria that determine when a species may be downlisted or delisted, and methods for monitoring recovery progress. Recovery plans also establish a framework for agencies to coordinate their recovery efforts and provide estimates of the cost of implementing recovery tasks. Recovery teams (comprised of species experts, Federal and State agencies, nongovernment organizations, and stakeholders) are often established to develop recovery plans. When completed, the recovery outline, draft recovery plan, and the final recovery plan will be available on our Web site (*http://www.fws.gov/endangered*), or from our Arizona Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**).

Implementation of recovery actions generally requires the participation of a broad range of partners, including other Federal agencies, States, Tribes, nongovernmental organizations, businesses, and private landowners. Examples of recovery actions include habitat restoration (e.g., restoration of native vegetation), research, captive propagation and reintroduction, and outreach and education. The recovery of many listed species cannot be accomplished solely on Federal lands because their range may occur primarily or solely on non-Federal lands. To achieve recovery of these species requires cooperative conservation efforts on private, State, and Tribal lands.

If these species are listed, funding for recovery actions will be available from a variety of sources, including Federal budgets, State programs, and cost share grants for non-Federal landowners, the academic community, and nongovernmental organizations. In addition, under section 6 of the Act, the State of Arizona would be eligible for Federal funds to implement management actions that promote the protection and recovery of the acuña cactus and the Fickeisen plains cactus. Information on our grant programs that are available to aid species recovery can be found at: *http://www.fws.gov/grants.*

Although the acuña cactus and the Fickeisen plains cactus are only proposed for listing under the Act at this time, please let us know if you are interested in participating in recovery efforts for either of these species. Additionally, we invite you to submit any new information on these species whenever it becomes available and any information you may have for recovery planning purposes (see **FOR FURTHER INFORMATION CONTACT**).

Section 7(a) of the Act requires Federal agencies to evaluate their actions with respect to any species that is proposed or listed as endangered or threatened and with respect to its critical habitat, if any is designated. Regulations implementing this interagency cooperation provision of the Act are codified at 50 CFR part 402. Section 7(a)(4) of the Act requires Federal agencies to confer with the Service on any action that is likely to jeopardize the continued existence of a species proposed for listing or result in destruction or adverse modification of proposed critical habitat. If a species is listed subsequently, section 7(a)(2) of the Act requires Federal agencies to ensure that activities they authorize, fund, or carry out are not likely to jeopardize the continued existence of the species or destroy or adversely modify its critical habitat. If a Federal action may affect a listed species or its critical habitat, the responsible Federal agency must enter into formal consultation with the Service.

Federal agency actions within both species' habitat that may require conference or consultation, or both, as described in the preceding paragraph include any management actions that could result in impacts to soil characteristics or seedbank viability, pollinators or their habitat, and associated native vegetation community, and any other landscape-altering activities on Federal lands administered by Federal agencies, such as: Issuance of section 404 Clean Water Act (33 U.S.C. 1251 et seq.) permits by the U.S. Army Corps of Engineers; construction and management of gas pipeline and power line rights-of-way by the Federal Energy Regulatory Commission; reauthorization of grazing permits by the BLM and the U.S. Forest Service, and construction and maintenance of roads or highways by the Federal Highway Administration.

The Act and its implementing regulations set forth a series of general prohibitions and exceptions that apply to endangered plants. All prohibitions of section 9(a)(2) of the Act, implemented by 50 CFR 17.61, apply. These prohibitions, in part, make it illegal for any person subject to the jurisdiction of the United States to import or export, transport in interstate or foreign commerce in the course of a commercial activity, sell or offer for sale in interstate or foreign commerce, or remove and reduce the species to possession from areas under Federal jurisdiction. In addition, for plants listed as an endangered species, the Act prohibits the malicious damage or destruction on areas under Federal jurisdiction and the removal, cutting, digging up, or damaging or destroying of such plants in knowing violation of any State law or regulation, including State criminal trespass law. Certain exceptions to the prohibitions apply to agents of the Service and State conservation agencies. The acuña cactus and the Fickeisen plains cactus are protected under the Arizona Native Plant Law as a highly safeguarded plant, which makes it unlawful for any person to destroy, dig up, cut, collect, mutilate, harvest or take, and place into possession any of these plants on public lands (Arizona Revised Statutes, Chapter 7, 2007, entire). However, the Arizona Native Plant Law does not prohibit landowners from removing or destroying protected plants on their property. They are required to notify the Arizona Department of Agriculture 20 to 60 days prior to destruction of a protected native plant on their private property. However, the Arizona Native Plant Law does not afford protection to the habitat of either cactus species, and there is no protection for the acuña cactus or the Fickeisen plains cactus on State lands, above what is allowable under the Arizona Native Plant Law.

We may issue permits to carry out otherwise prohibited activities involving endangered and threatened plant species under certain circumstances. Regulations governing permits are codified at 50 CFR 17.62 for endangered plants, and at 17.72 for threatened plants. With regard to endangered plants, a permit must be issued for the following purposes: For scientific purposes, or for the enhancement of propagation or survival of the species.

It is our policy, as published in the **Federal Register** on July 1, 1994 (59 FR 34272), to identify to the maximum extent practicable at the time a species

is listed, those activities that would or would not constitute a violation of section 9 of the Act. The intent of this policy is to increase public awareness of the effect of a proposed listing on proposed and ongoing activities within the range of species proposed for listing. The following activities could potentially result in a violation of section 9 of the Act. Unauthorized collecting, handling, possessing, selling, delivering, carrying, or transporting of the species, including import or export across State lines and international boundaries, except for properly documented antique specimens of these taxa at least 100 years old, as defined by section 10(h)(1) of the Act.

Questions regarding whether specific activities would constitute a violation of section 9 of the Act should be directed to the Arizona Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**).

Critical Habitat

Background

Critical habitat is defined in section 3 of the Act as:

(1) The specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the Act, on which are found those physical or biological features

(a) Essential to the conservation of the species and

(b) Which may require special management considerations or protection; and

(2) Specific areas outside the geographical area occupied by the species at the time it is listed, upon a determination that such areas are essential for the conservation of the species.

Conservation, as defined under section 3 of the Act, means to use and the use of all methods and procedures that are necessary to bring an endangered or threatened species to the point at which the measures provided pursuant to the Act are no longer necessary. Such methods and procedures include, but are not limited to, all activities associated with scientific resources management such as research, census, law enforcement, habitat acquisition and maintenance, propagation, live trapping, and transplantation, and, in the extraordinary case where population pressures within a given ecosystem cannot be otherwise relieved, may include regulated taking.

Critical habitat receives protection under section 7 of the Act through the requirement that Federal agencies ensure, in consultation with the Service, that any action they authorize, fund, or carry out is not likely to result in the destruction or adverse modification of critical habitat. The designation of critical habitat does not affect land ownership or establish a refuge, wilderness, reserve, preserve, or other conservation area. Such designation does not allow the government or public to access private lands. Such designation does not require implementation of restoration, recovery, or enhancement measures by non-Federal landowners. Where a landowner requests Federal agency funding or authorization for an action that may affect a listed species or critical habitat, the consultation requirements of section 7(a)(2) of the Act would apply, but even in the event of a destruction or adverse modification finding, the obligation of the Federal action agency and the landowner is not to restore or recover the species, but to implement reasonable and prudent alternatives to avoid destruction or adverse modification of critical habitat.

Under the first prong of the Act's definition of critical habitat, areas within the geographical area occupied by the species at the time it was listed are included in a critical habitat designation if they contain physical or biological features (1) essential to the conservation of the species and (2) which may require special management considerations or protection. For these areas, critical habitat designations identify, to the extent known using the best scientific and commercial data available, those physical or biological features that are essential to the conservation of the species (such as space, food, cover, and protected habitat). In identifying those physical and biological features within an area, we focus on the principal biological or physical constituent elements (primary constituent elements such as roost sites, nesting grounds, seasonal wetlands, water quality, tide, soil type) that are essential to the conservation of the species. Primary constituent elements are the specific elements of physical or biological features that provide for a species' life-history processes, and are essential to the conservation of the species.

Under the second prong of the Act's definition of critical habitat, we can designate critical habitat in areas outside the geographical area occupied by the species at the time it is listed, upon a determination that such areas are essential for the conservation of the species. We designate critical habitat in areas outside the geographical area occupied by a species only when a designation limited to its range would be inadequate to ensure the conservation of the species.

Section 4 of the Act requires that we designate critical habitat on the basis of the best scientific data available. Further, our Policy on Information Standards Under the Endangered Species Act (published in the **Federal Register** on July 1, 1994 (59 FR 34271)), the Information Quality Act (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001 (Pub. L. 106–554; H.R. 5658)), and our associated Information Quality Guidelines, provide criteria, establish procedures, and provide guidance to ensure that our decisions are based on the best scientific data available. They require our biologists, to the extent consistent with the Act and with the use of the best scientific data available, to use primary and original sources of information as the basis for recommendations to designate critical habitat.

When we are determining which areas should be designated as critical habitat, our primary source of information is generally the information developed during the listing process for the species. Additional information sources may include the recovery plan for the species, articles in peer-reviewed journals, conservation plans developed by States and counties, scientific status surveys and studies, biological assessments, other unpublished materials, or experts' opinions or personal knowledge.

Habitat is dynamic, and species may move from one area to another over time. We recognize that critical habitat designated at a particular point in time may not include all of the habitat areas that we may later determine are necessary for the recovery of the species. For these reasons, a critical habitat designation does not signal that habitat outside the designated area is unimportant or may not be needed for recovery of the species. Areas that are important to the conservation of the species, both inside and outside the critical habitat designation, will continue to be subject to: (1) Conservation actions implemented under section 7(a)(1) of the Act, (2) regulatory protections afforded by the requirement in section 7(a)(2) of the Act for Federal agencies to ensure their actions are not likely to jeopardize the continued existence of any endangered or threatened species, and (3) the prohibitions of section 9 of the Act if actions occurring in these areas may affect the species. Federally funded or permitted projects affecting listed species outside their designated critical

habitat areas may still result in jeopardy findings in some cases. These protections and conservation tools will continue to contribute to recovery of this species. Similarly, critical habitat designations made on the basis of the best available information at the time of designation will not control the direction and substance of future recovery plans, habitat conservation plans (HCPs), or other species conservation planning efforts if new information available at the time of these planning efforts calls for a different outcome.

Prudency Determination for the Acuña Cactus and the Fickeisen Plains Cactus

Section 4(a)(3) of the Act, as amended, and implementing regulations (50 CFR 424.12), require that, to the maximum extent prudent and determinable, the Secretary designate critical habitat at the time the species is determined to be an endangered or threatened species. Our regulations (50 CFR 424.12(a)(1)) state that the designation of critical habitat is not prudent when one or both of the following situations exist: (1) The species is threatened by taking or other human activity, and identification of critical habitat can be expected to increase the degree of threat to the species; or (2) such designation of critical habitat would not be beneficial to the species.

There is no documentation that the acuña cactus and the Fickeisen plains cactus are threatened by collection. Therefore, they are unlikely to experience increased threats by the identification and mapping of critical habitat. In the absence of a finding that the designation of critical habitat would increase threats to a species, if there are any benefits to a critical habitat designation, then a prudent finding is warranted. The potential benefits of designation include: (1) Triggering consultation under section 7 of the Act, in new areas for actions in which there may be a Federal nexus where it would not otherwise occur because, for example, it is or has become unoccupied or the occupancy is in question; (2) focusing conservation activities on the most essential features and areas; (3) providing educational benefits to State or county governments or private entities; and (4) preventing people from causing inadvertent harm to the species.

The primary regulatory effect of critical habitat is the Act's section 7(a)(2) requirement that Federal agencies refrain from taking any action that destroys or adversely modifies critical habitat. At present, the acuña cactus and the Fickeisen plains cactus occurs on Federal, State, Tribal, and private lands in Arizona. Lands proposed for designation as critical habitat would be subject to Federal actions that trigger the section 7 consultation requirements. These include land management actions and permitting by the BLM, OPCNM, and BMGR for the acuña cactus; and by the BLM and Kaibab National Forest for the Fickeisen plains cactus. In addition, lands proposed for designation as critical habitat, whether or not under Federal jurisdiction, may be subject to Federal actions that trigger the section 7 consultation requirement, such as the granting of Federal monies or Federal permits.

There may also be some educational or informational benefits to the designation of critical habitat. Educational benefits include the notification of lessees and the general public of the importance of protecting habitat.

Although we make a detailed determination of the habitat needs of a listed species during the recovery planning process, the Act has no provision to delay designation of critical habitat until such time as a recovery plan is prepared. We reviewed the available information pertaining to habitat characteristics where these two species are located. This and other information represent the best scientific data available and lead us to conclude that the designation of critical habitat is prudent for the acuña cactus and the Fickeisen plains cactus.

Critical Habitat Determinability for the Acuña Cactus and the Fickeisen Plains Cactus

As stated above, section 4(a)(3) of the Act requires the designation of critical habitat concurrently with the species' listing ''to the maximum extent prudent and determinable.'' Our regulations at 50 CFR 424.12(a)(2) state that critical habitat is not determinable when one or both of the following situations exist:

(i) Information sufficient to perform required analyses of the impacts of the designation is lacking, or

(ii) The biological needs of the species are not sufficiently well known to permit identification of an area as critical habitat.

When critical habitat is not determinable, the Act provides for an additional year to publish a critical habitat designation (16 U.S.C. 1533(b)(6)(C)(ii)).

We reviewed the available information pertaining to the biological needs of the species and habitat characteristics where this species is located. This and other information represent the best scientific data available and led us to conclude that the designation of critical habitat is determinable for the acuña cactus and the Fickeisen plains cactus.

Acuña Cactus

Physical or Biological Features

In accordance with section 3(5)(A)(i) and 4(b)(1)(A) of the Act and regulations at 50 CFR 424.12, in determining which areas within the geographical area occupied by the species at the time of listing to designate as critical habitat, we consider the physical or biological features that are essential to the conservation of the species and which may require special management considerations or protection. These include, but are not limited to:

(1) Space for individual and population growth and for normal behavior;

(2) Food, water, air, light, minerals, or other nutritional or physiological requirements;

(3) Cover or shelter;

(4) Sites for breeding, reproduction, or rearing (or development) of offspring; and

(5) Habitats that are protected from disturbance or are representative of the historical, geographic, and ecological distributions of a species.

We derive the specific physical or biological features required for the acuña cactus from studies of this species' habitat, ecology, and life history as described below. We have determined that the physical or biological features described below are essential for the acuña cactus.

Habitat for Individual and Population Growth, Including Sites for Germination, Pollination, Reproduction, Pollen and Seed Dispersal, and Seed Banks

Pollination and Pollen Dispersal—Preservation of the mix of species and interspecific interactions they encompass greatly improves the chances for on-site survival of rare species (Tepedino *et al.* 1996, p. 245). Bee nesting habitat, foraging plants, and corridors must be preserved to protect the acuña cactus (Buchmann 2012, pers. comm.; McDonald 2007, p. 4). The acuña cactus relies solely on the production of seeds for reproduction, with pollination highly linked to the acuña cactus' survival. A lack of pollinators would lead to a reduction of seed production that would lead, in turn, to a gradual reduction in the seed bank (Wilcock and Neiland 2002, p. 276). Although viability of seed in the

seed bank is unknown, germination trials in the greenhouse suggest the seeds are short-lived (Rutman 2007, p. 7), thus this could result in decrease in the acuña cactus population's persistence.

Successful pollination depends on the pollinator species needed and the distance the pollinator can travel between flowers (McDonald 2005, p. 15). Acuña cacti are pollinated by a suite of bees from the Andrenidae, Anthophoridae, Anthophorinae, Halictidae, and Megachilidae families; however, the most abundant, robust, and consistent visitors in a 2-year study at OPCNM were leafcutter bee (*Megachile palmensis*) and cactus bee (*Diadasia rinconis*) (Johnson 1992, p. 406). Leafcutter and cactus bees are native cactus specialist bees requiring a sufficient quantity of the acuña and other cacti pollen throughout their foraging season to provide a continuous source of pollen to provision their nests and support their own survivorship (Blair and Williamson 2008, p. 428).

No studies of pollinator dispersal distance have been conducted for the acuña cactus; however, in a study of a similar rare cactus of Arizona's Sonoran Desert, the Pima pineapple cactus, McDonald (2005, p. 29) determined that the maximum distance that the cactus bees travelled between Pima pineapple cactus individuals was 900 m (2,953 ft). The maximum distance travelled by the leafcutter bee is thought to be less than this (Buchmann 2012, pers. comm.). This distance around individual cacti is needed to support pollinator foraging, nesting, and survivorship.

Therefore, based on our review of the best available information, we identify a pollination area with a radius of 900 m (2,953 ft) around each reproducing acuña cactus plant as a physical or biological feature of acuña cactus habitat.

Seed Dispersal, Germination, Growth, and Seed Banks—Bare soils within the seed dispersal range of the acuña cactus are necessary for recruitment and soil seed banking. Primary and secondary dispersal of these seeds can occur via a number of mechanisms including gravity, ants, wind, or rain (Butterwick 1982–1992, entire; Rutman 1996b, pers. comm.; Rutman 2001, pers. comm.; Anderson 2011, p. 1). Primary dispersal is the movement of seeds short distances from the plant, whereas secondary dispersal involves the redistribution of seeds by living (e.g., insects) or non-living (e.g., wind) factors (van Rheede van Oudtshorrn and van Rooyen 1999, pp. 186–187).

As evidenced by their commonly clumped habit, the majority of the acuña cactus seeds are dispersed by gravity; that is, they fall very close to the mother plant, which serves as a nurse plant for germination (Johnson *et al.* 1993, p. 178). Although with this type of dispersal the distance seeds travel is limited, the immediate environment of the mother plant is typically very suitable for establishment, and these seeds have a better chance of germination, establishment, and survival than seeds dispersed by other mechanisms (van Rheede van Oudtshorrn and van Rooyen 1999, p. 91).

Ants have been reported to both transport and consume the seeds of the acuña cactus (Butterwick 1982–1992, entire; Rutman 1996b, pers. comm.; Rutman 2001, pers. comm.; Anderson 2011, p. 1). Transported seeds may be dropped, discarded, or buried at either an appropriate or inappropriate depth for germination and emergence (van Rheede van Oudtshorrn and van Rooyen 1999, p. 15). Transported seed has the benefit of reduced competition from other seeds and reduced rodent predation found near the mother plant (O'Dowd and Hay 1980, p. 536; Vander Wall *et al.* 2005, p. 802). The maximum distance seeds are dispersed by ants is typically less than 3 m (9.8 ft) and rarely more than 10 m (32.8 ft) (van Rheede van Oudtshorrn and van Rooyen 1999, p. 186).

The maximum distance seeds are dispersed by wind depends on many factors including the height of the plant, characteristics of the surrounding vegetation, seed mass and size, and wind conditions (van Rheede van Oudtshorrn and van Rooyen 1999, p. 186). Secondary dispersal by wind can be farther in deserts, where vegetation is widely spaced and interspaces between trees and shrubs support wind velocities as much as four times higher than under trees and shrubs (van Rheede van Oudtshorrn and van Rooyen 1999, p. 187). Wind-blown soil, litter, and small seeds accumulate under shrubs and trees, or in soil surface depressions (Shreve 1942, p. 205; van Rheede van Oudtshorrn and van Rooyen 1999, p. 187).

Dispersal of seed from rain wash or sheet flow over the ground is considered to occur across a relatively short distance; in hot deserts, many plants disperse seed by rain (van Rheede van Oudtshorrn and van Rooyen 1999, pp. 69, 76). The distance that the acuña cactus seeds travel by either wind or water is not known; however, spacing of associated nurse trees and shrubs where soil, litter, and seed could accumulate is roughly 8 m (26.2 ft). This number was determined by using the average height of the largest tree associate, palo verde, as height and density are closely related (Shreve 1942, pp. 202–203; Kearney and Peebles 1951, p. 407).

Therefore, based on our review of the best available information regarding the maximum distance that seed may be expected to disperse, and within which the acuña cactus seed banks, seedling establishment, and seedling growth can occur, we identify bare soils immediately adjacent to and within 10 m (32.8 ft) of existing reproductive acuña cactus plants as a physical or biological feature of acuña cactus habitat.

Appropriate Geological Layers and Topography That Support Individual Acuña Cactus Plants

Geology—Bedrock and soil chemistry could help explain the current distribution of the acuña cactus across small islands of habitat in southern Arizona. Various reports describe the acuña cactus occurring on both fine and course textured soils derived from volcanic, granitic, and metamorphic rocks (Geraghty and Miller 1997, p. 3; Rutman 2007, pp. 1–2). Specifically, parent rock materials of preferred habitat include extrusive felsic volcanic rocks of rhyolite, andesite, and tuff, and intrusive igneous rocks composed of granite, granodiorite, diorite, and quartz monzonite (Rutman 2007, pp. 1–2).

We applied this knowledge of the acuña cactus geologic habitat preference by analyzing geology features and known plant locations attained for populations occurring within the United States using Geographic Information Systems (GIS). We determined 11 geologic feature classes that occur within the known locations of the acuña cactus in the United States (Arizona State Land Department 2012, GIS data layer). These feature classes can be summarized as Volcanic rocks from the middle Miocene to Oligocene and from the Jurassic; Granitoid rocks from the early Tertiary to Late Cretaceous and from the Jurassic; Granitic rocks from the early Tertiary to Late Cretaceous; Metamorphic rocks from the early Proterozoic; and surficial deposits from the Holocene to the latest Pliocene. Therefore, based on our review of the best available information regarding bedrock geology and associated soils required by the acuña cacti, we identify the presence of any one of these 11 feature classes as a physical or biological feature of acuña cactus habitat. These feature classes can be further summarized to include the following rock types as identified in the literature for this species: rhyolite, andesite, tuff, granite, granodiorite,

diorite, or Cornelia quartz monzonite (Rutman 2007, pp. 1, 2).

Topography—The acuña cactus is known to occur in valley bottoms and on ridge tops or small knolls, on slopes up to 30 percent (Phillips *et al.* 1982, p. 4; Geraghty and Miller 1997, p. 3). We applied this knowledge of the acuña topographic habitat preference by analyzing topography features using a digital elevation model in GIS. Therefore, based on our review of the best available information regarding topography, we identify valley bottoms, ridge tops, and small knolls with slopes of 30 percent or less as a physical or biological feature of acuña cactus habitat.

Appropriate Vegetation Community and Elevation Range That Support Individual Acuña Cactus Plants

Nurse Plants—Known populations of the acuña cactus have been reported from between 365 and 1,150 m (1,198 to 3,773 ft) elevation within the paloverde-cacti-mixed scrub series of the Arizona Upland Subdivision of the Sonoran Desert-scrub (Brown 1994, p. 200; Arizona Rare Plant Guide Committee 2001, unnumbered pages; AGFD 2011, entire). This scrubland or low woodland contains leguminous trees, shrubs, and succulents including *Cercidium microphyllum* (palo verde), *Olneya tesota* (ironwood), *Larrea tridentata* var. *tridentata* (creosote bush), *Ambrosia* spp. (bursage), and *Carnegia gigantea* (saguaro). The acuña cactus seedlings benefit from the protection of these native Sonoran Desert trees and shrubs, as well as other larger acuña cacti that act as nurse plants by providing protection from temperature extremes and physical damage (Felger 2000, p. 208; Johnson *et al.* 1993, p. 178). The acuña cactus individuals are generally more robust in these situations, as opposed to in open, exposed locations (Felger 2000, p. 208). Therefore, based on the information above, we identify the presence of creosote bush, ironwood, palo verde, and other native protective plants to be a physical or biological feature necessary for acuña cactus survival.

Native Vegetation Dominance—The acuña cactus habitat should be relatively free from perennial grass invaders as these alter structure, function, dominance, and disturbance regimes, and have been shown to drastically lower species diversity, within the Sonoran Desert (Olsson *et al.* 2012, p. 10). Such changes have great potential to impact acuña cacti and their pollinators. In addition, such introduced grasses as buffelgrass form continuous mats and remove open bare ground for nesting bees such as *Diadasia* spp. (Buchmann 2007, p. 13). These bees move nesting sites yearly to shed parasites, therefore requiring the continued availability of sandy, well-drained, bare ground available to create nests (Buchmann 2012, pers. comm.). Therefore, based on our review of the best available information, we identify Sonoran Desert-scrub habitat dominated by native plant species to be a physical or biological feature necessary for acuña cactus survival.

Primary Constituent Elements for the Acuña Cactus

Under the Act and its implementing regulations, we are required to identify the physical or biological features essential to the conservation of acuña cactus in areas occupied at the time of listing, focusing on the features' primary constituent elements. We consider primary constituent elements to be the elements of physical or biological features that provide for a species' life-history processes and are essential to the conservation of the species.

Based on our current knowledge of the physical or biological features and habitat characteristics required to sustain the species' life-history processes, we determine that the primary constituent elements specific to the acuña cactus are:

(i) Native vegetation within the Paloverde-Cacti-Mixed Scrub Series of the Arizona Upland Subdivision of the Sonoran Desert-scrub at elevations between 365 to 1,150 m (1,198 to 3,773 ft). This vegetation must contain predominantly native plant species that:

a. Provide protection to the acuña cactus. Examples of such plants are creosote bush, ironwood, and palo verde;

b. Provide for pollinator habitat with a radius of 900 m (2,953 ft) around each individual, reproducing acuña cactus;

c. Allow for seed dispersal through the presence of bare soils immediately adjacent to and within 10 m (32.8 ft) of individual, reproducing acuña cactus.

(ii) Soils overlying rhyolite, andesite, tuff, granite, granodiorite, diorite, or Cornelia quartz monzonite bedrock that are in valley bottoms, on small knolls, or on ridgetops, and are generally on slopes of less than 30 percent.

Special Management Considerations or Protection

When designating critical habitat, we assess whether the specific areas within the geographical area occupied by the species at the time of listing contain features which are essential to the conservation of the species and which may require special management considerations or protection. The features essential to the conservation of the acuña cactus may require special management considerations or protection to reduce the following threats: livestock grazing; border activities; ORV use; mining; and nonnative, invasive plant species. Currently some of these threats are not identified to occur at a level that threatens populations with extinction; however without management of these threats, they could rise to this level. Refer to the five-factor analysis above for more information on these threats. Management activities that could ameliorate these threats include, but are not limited to, improving habitats and potentially increasing plant population numbers on lands the BLM, NPS, or the State of Arizona currently holds or may hold in the future. Special management to protect the features essential to the conservation of the species include conservation measures and actions to minimize effects of livestock grazing, road and trail building; construction of new border control facilities, towers or fences, ORV use, and mining, and to control nonnative, invasive plants on these lands. These management activities will protect the essential physical or biological features for the species by maintaining native vegetation communities, preserving soil characteristics, and providing habitat for the acuña cactus and its pollinators.

Criteria Used To Identify Critical Habitat

As required by section 4(b)(2) of the Act, we use the best scientific data available to designate critical habitat. We review available information pertaining to the habitat requirements of the species. In accordance with the Act and its implementing regulation at 50 CFR 424.12(e), we consider whether designating additional areas—outside those currently occupied as well as those occupied at the time of listing—are necessary to ensure the conservation of the species. We are proposing to designate critical habitat in areas within the geographical area occupied by the species at the time of listing, as described above in the proposed rule to list the acuña cactus, and contain sufficient elements of physical or biological features to support life-history processes essential for the conservation of the species. We also are proposing to designate specific areas outside the geographical area occupied by the species at the time of listing that we have determined to be essential to the conservation of the species.

We reviewed available information and supporting data that pertain to the

habitat requirements of the acuña cactus. This information included research published in peer-reviewed articles and presented in academic theses and agency reports, as well as data collected from long-term monitoring plots, interviews with experts, and regional climate data and GIS coverage. Sources of information include, but are not limited to, Brown 1994, Buchmann 2007, Butterwick 1982–1992, Felger 2000, Holm 2006, Johnson 1992, Johnson *et al.* 1993, McDonald 2007, Olsson *et al.* 2012, Phillips *et al.* 1982, NPS 2011a, NPS 2011b, Rutman 2007, Van Rheede van Oudtshorrn, K. and M.W. van Rooyen 1999, and WRCC 2012. Based on this information, we developed a strategy for determining which areas meet the definition of critical habitat for acuña cactus.

Occupied Area at the Time of Listing

In identifying proposed critical habitat units for acuña cactus, we proceeded through a multi-step process. We obtained all records for acuña cactus distribution from AGFD, as well as both published and unpublished documentation from our files. There is no information on the historical range of this species; survey results confirm that plant distribution is comprised of disjunct occupied habitat in two general areas of south-central Arizona.

Our approach to delineating critical habitat units was applied in the following manner:

(1) We overlaid acuña cactus locations into a GIS database. This provided us with the ability to examine slope, aspect, elevation, geologic type, vegetation community, and topographic features. These data points verified and slightly expanded the previously recorded elevation ranges for acuña cactus.

(2) In addition to the GIS layers listed above, we then included a 900-m (2,953-ft) buffer around known populations to ensure that all potential pollinators would have a sufficient land base to establish nesting sites and to provide pollinating services for acuña cactus, as described in *Physical or Biological Features* for the Acuña cactus above.

(3) We then drew critical habitat boundaries that captured the locations elucidated under (1) and (2) above. Critical habitat designations were then mapped using Albers Equal Area (Albers) North American Datum 83 (NAD 83) coordinates.

We defined six units within the current distribution of the species in two general areas of south-central Arizona. Two of the subunits are not occupied at the time of listing; the remaining units and subunits contain approximately 2,730 individuals. Within these units and subunits, several geologic, topographic, elevation, slope, and vegetation community features have been defined which, in combination, create appropriate acuña cactus habitat that is essential to the conservation of the species, though not all lands containing this combination support the acuña cacti.

Areas Essential for the Conservation of Acuña Cactus Outside of Occupied Areas

As discussed above in the five-factor analysis and ''Drought and Climate Change'' section, with reduced annual precipitation over the past 30 years, mature acuña cactus plants produce fewer flowers and seeds, and seedling establishment and survival does not offset mortality. Increased insect attack, possibly due to warmer winter temperatures throughout the region, in combination with water and heat stresses, have resulted in a documented mortality of more than 80 percent of individuals within populations that have been visited more than once.

Although the specific water needs of the species are unknown, acuña cactus seedlings require adequate precipitation for survival, and adults require precipitation for flowering and fruit set. To determine what amount of precipitation is adequate, we analyzed precipitation monitoring records from OPCNM. Through our analysis, we determined the acuña cactus flower production and recruitment peaked in 1992, when 902 flowers were produced (Holm 2006, p. 2–10) following a winter period with total precipitation of 29.7 cm (11.66 in) (WRCC 2012, entire). Flower production reached measured lows in 1999, 2002, and 2006 (NPS 2011a, p. 2), years when total winter precipitation ranged between 2.2 and 3.3 cm (0.85 and 1.3 in) (WRCC 2012, entire). Similarly, recruitment peaked in the early 1990s (Holm 2006, p. 2–6; NPS 2011a, p. 1), following a 1990 summer period with 24.6 cm (9.7 in) of precipitation (WRCC 2012, entire). Therefore, based on our review of the best available information, we identify that areas that currently receive 29.7 cm (11.66 in) or higher total yearly precipitation are necessary for the acuña cactus reproduction and survival due to the continuing and impending region-wide drought.

Following determination of critical habitat as outlined in the previous section, we then used an overlay of the areas containing appropriate geology, vegetation community, percent slope, and elevation, as defined in the physical and biological features, plus Parameter-elevation Regressions on Independent Slopes Model (PRISM) climate data, to map areas that contain the correct geology, vegetation community, elevation range, and slope range, and that receive 29.7 cm (11.66 in) or more annual precipitation over a 30-year average (see the *Physical or Biological Features* for the Acuña catus above). The result was additional polygons representing suitable habitat which are not known to be occupied at the time of listing, but that contain appropriate habitat for the species, and are more northerly, higher in elevation, and receive higher mean annual precipitation than other acuña cactus habitat. It is generally recognized that as climate change progresses, species will move both north and upslope to adapt to hotter and dryer climate (Lesica and McCune 2004, p. 687). Our reasoning in defining these two additional areas as critical habitat is that they will provide the greatest probability of higher precipitation and cooler temperatures of the available acuña cactus habitat throughout south-central Arizona, and thus provide an avenue for natural expansion of the species' range (small mammals and birds likely disperse the red fruits) and for off-site conservation efforts (transplant populations). Areas that currently support the cactus will, hopefully, continue to support the cactus in the future; however, given the ongoing drought and the predictions for reduced precipitation throughout the region, we conclude that additional areas are essential to the conservation of the species.

When determining proposed critical habitat boundaries, we made every effort to avoid including developed areas such as lands covered by buildings, pavement, and other structures because such lands lack physical or biological features for the acuña cactus. The scale of the maps we prepared under the parameters for publication within the Code of Federal Regulations may not reflect the exclusion of such developed lands. Any such lands inadvertently left inside critical habitat boundaries shown on the maps of this proposed rule have been excluded by text in the proposed rule and are not proposed for designation as critical habitat. Therefore, if the critical habitat is finalized as proposed, a Federal action involving these lands would not trigger section 7 consultation with respect to critical habitat and the requirement of no adverse modification unless the specific action would affect the physical or biological features in the adjacent critical habitat.

The critical habitat designation is defined by the map or maps, as modified by any accompanying regulatory text, presented at the end of this document in the rule portion. We include more detailed information on the boundaries of the critical habitat designation in the preamble of this document. We will make the coordinates or plot points or both on which each map is based available to the public on *http://www.regulations.gov* at Docket No. FWS–R2–ES–2012–0061, on our Internet sites *http://www.fws.gov/southwest/es/arizona/,* and at the field office responsible for the designation (see **FOR FURTHER INFORMATION CONTACT** above).

Proposed Critical Habitat Designation for Acuña Cactus

We are proposing six units as critical habitat for the acuña cactus. The critical habitat areas we describe below constitute our current best assessment of areas that meet the definition of critical habitat for the acuña cactus. The six units we propose as critical habitat are: (1) Organ Pipe Cactus National Monument, (2) Ajo, (3) the Sauceda Mountains, (4) the Sand Tank Mountains, (5) Mineral Mountain, and (6) Box O Wash. Table 5 shows the occupied units.

TABLE 5—OCCUPANCY OF THE ACUÑA CACTUS BY PROPOSED CRITICAL HABITAT UNITS

Unit	Occupied at time of listing?
1. Organ Pipe Cactus National Monument Unit:	
Dripping Spring	Yes.
Acuña Valley	Yes.
2. Ajo Unit:	
Townsites	Yes.
Little Ajo Mountains	Yes.
3. Sauceda Mountains Unit:	
Coffeepot Mountain	Yes.
Cimarron Mountain	No.
4. Sand Tank Mountains Unit:	
Javelina Mountain	Yes.
Sand Tank Mountain	No.
5. Mineral Mountain Unit	Yes.
6. Box O Wash Unit	Yes.

The approximate area of each proposed critical habitat unit is shown in Table 6.

TABLE 6—PROPOSED CRITICAL HABITAT UNITS FOR THE ACUÑA CACTUS

Unit	Subunit	Federal	State	Tribal	Private	Total
		Ha (Ac)	Ha (Ac)	Ha (Ac)	Ha (Ac)	Ha (Ac)
1. Organ Pipe Cactus National Monument.	Dripping Spring	1,591 (3,931)	0	0	0	1,591 (3,931)
	Acuña Valley	2,416 (5,971)	0	0	0	2,416 (5,971)
Unit Total		4,007 (9,902)	0	0	0	4,007 (9,902)
2. Ajo	Townsites	89 (220)	0	0	330 (815)	419 (1,035)
	Little Ajo Mountains.	106 (263)	0	0	141 (347)	247 (610)
Unit Total		195 (483)	0	0	470 (1,162)	666 (1,645)
3. Sauceda Mountains.	Coffeepot Mountain.	1,481 (3,659)	0	156 (385)	0	1,637 (4,044)
	Cimarron Mountain.	0	0	2,100 (5,190)	0	2,100 (5,190)
Unit Total		1,481 (3,659)	0	2,256 (5,575)	0	3,737 (9,234)
4. Sand Tank Mountains.	Javelina Mountain	911 (2,251)	0	0	0	911 (2,251)
	Sand Tank Mountain.	3,107 (7,677)	0	0	0	3,107 (7,677)
Unit Total		4,018 (9,928)	0	0	0	4,018 (9,928)
5. Mineral Mountain.		874 (2,160)	217 (537)	0	0	1,092 (2,697)
6. Box O Wash		1,378 (3,404)	5,556 (13,729)	0	1,287 (3,180)	8,221 (20,314)
Grand Total		11,953 (29,536)	5,773 (14,266)	2,256 (5,575)	1,757 (4,342)	21,740 (53,720)

Note: Area sizes may not sum due to rounding.

We present brief descriptions of all units, and reasons why they meet the definition of critical habitat for the acuña cactus, below.

Unit 1: Organ Pipe Cactus National Monument

Unit 1 is located within OPCNM, in southwestern Pima County, Arizona. The unit consists of two subunits totaling 4,007 ha (9,902 ac), of which all is federally owned land. The Federal land is administered by the NPS.

Unit 1a: Acuña Valley—Unit 1a consists of 2,416 ha (5,971 ac) in central OPCNM. Lands within this subunit are occupied at the time of listing with the largest known population of the acuña

cactus, approximately 2,000 individuals. This subunit contains all of the primary constituent elements of the physical or biological features essential to the conservation of the acuña cactus.

Unit 1b: Dripping Spring—Unit 1b consists of 1,591 ha (3,931ac) in southern OPCNM. An acuña cactus herbarium specimen was collected from within this unit in 1952. A general location was recorded on this specimen, and from this information, a GIS map was created by the AGFD. Because OPCNM personnel were not aware that an acuña cactus had been collected in this area, they did not revisit the area to survey for the species and are not able to survey now due to security issues along the border. We believe there is a possibility this population remains extant because: (1) We know of no other acuña cactus population that has been extirpated. This unit is in the center between the two largest known populations, which are located in the United States and Mexico. There have been no natural, environmental changes from climate change, drought, or insect predation that have caused an acuña cactus population in the two largest known populations to be extirpated. Because this unit is centered between the two largest known populations, we have no evidence to indicate that climate change, drought, or insect predation have extirpated this population. (2) Episodic recruitment events during years of higher than average precipitation may have occurred in this population since the time of its discovery. The acuña cactus may not have been reproducing offspring in periods of drought years, but there have been periods since 1952 there was enough precipitation that would have resulted in higher than average reproduction. In his 3-year study of the reproductive ecology of the acuña cactus in Unit 1a, Johnson (1992, pp. 403, 405) concluded that the positive association of rainfall and annual variation in the number of flowers produced indicates that water availability limits flower production in this species. Within monitoring plots established by Buskirk in 1977 (Buskirk 1981, p. 1), total flowers counted peaked at 902 in 1992 (Holm 2006, p. 10); corresponding precipitation during the winter of 1992–1993 was 29.7 cm (11.66 in) (WRCC 2012, entire). Even though cacti in this unit were not monitored, it is likely that recruitment events during years of higher than average precipitation may have occurred in this population. (3) This species appears to be fairly long-lived. The OPCNM has been monitoring individuals for 35 years in Unit 1a, and it is likely that individuals have a life span that is much longer. Even though this plant has not been looked for in this unit since 1952, it is likely that some individuals, or their offspring, that were alive in 1952 remain in this unit today. (4) Even though illegal border activities may have potentially caused damage to the acuña cactus and its habitat in this unit, we have no evidence to indicate that these activities have occurred at such a level the acuña cactus population in this unit has been extirpated. Therefore, for the reasons stated above, we consider this subunit occupied at the time of listing. This subunit contains all of the primary constituent elements of the physical or biological features essential to the conservation of the acuña cactus.

Grazing and mining are not permitted within OPCNM; however, off-road border-related activities do occur in OPCNM. Special management considerations or protections may be required within each subunit to address off-road border-related human disturbances, invasive plant removal, and insect predation in acuña cactus habitat.

Unit 2: Ajo

Unit 2 is located in and near the town of Ajo in southwestern Pima County, Arizona. The unit consists of two subunits totaling 666 ha (1,645 ac). This unit contains 195 ha (483 ac) of federally owned land and 470 ha (1,162 ac) of private land. The Federal land is administered by the BLM.

Subunit 2a: Townsites—Subunit 2a consists of 330 ha (815 ac) of private land and 89 ha (220 ac) of BLM land in and around the town of Ajo, Arizona. This subunit is comprised of three separate populations of the acuña cactus on private and BLM lands, which are close enough in proximity to be combined within the 900 m (2,953 ft) radius defined for pollinators. Lands within this subunit are occupied at the time of listing; the combined number of plants occurring within this subunit is 33. This subunit contains all of the primary constituent elements of the physical or biological features essential to the conservation of the acuña cactus.

Subunit 2b: Little Ajo Mountains—Subunit 2b consists of 106 ha (263 ac) of BLM lands and 141 ha (347 ac) of private lands south of the town of Ajo, Arizona. Lands within this subunit are occupied at the time of listing, containing seven individual plants. This subunit contains all of the primary constituent elements of the physical or biological features essential to the conservation of the acuña cactus.

The features essential to the conservation of the species within both subunits are threatened by mining, urban development, off-road border activities, and exotic plant invasion. Special management considerations or protections may be required within the subunits to minimize habitat fragmentation; to minimize disturbance to acuña cactus individuals, soil, and associated native vegetation; and to prevent or remove invasive, exotic plants within the acuña cactus habitat.

Unit 3: Sauceda Mountains

Unit 3 is located in the Sauceda Mountains of northwestern Pima and southwestern Maricopa Counties, Arizona. This unit consists of two subunits totaling 3,737 ha (9,234 ac). This unit contains 1,481 ha (3,659 ac) of federally owned land and 2,256 ha (5,575 ac) of Tribally owned land. The Federal land is administered by the BLM and BMGR; the Tribal land is administered by the Tohono O'odham Nation. We will coordinate with the Tribe and examine what conservation actions, management plans, and commitments and assurances for the acuña cactus occur on these lands for potential exclusion from the final designation of critical habitat under section 4(b)(2) of the Act.

Subunit 3a: Coffeepot Mountain—Subunit 3a consists of 1,637 ha (4,044 ac) in the Sauceda Mountains of northwestern Pima and southwestern Maricopa Counties, on and near Coffeepot Mountain. This subunit is comprised of four separate populations on lands administered by the BLM (1,102 ha (2,724 ac)), the BMGR (378 ha (935 ac)), and the Tohono O'odham Nation (156 ha (385 ac)), which are close enough in proximity as to be combined within the 900 m (2,953 ft) radius defined for pollinators. Lands within this subunit are occupied at the time of listing; the combined number of plants occurring within this subunit is 445. This subunit contains all of the primary constituent elements of the physical or biological features essential to the conservation of the acuña cactus.

The features essential to the conservation of the species within subunit 3a are threatened by mining, grazing, and off-road border activities. Special management considerations or protections may be required within the unit to minimize habitat fragmentation; to minimize disturbance to individual acuña cactus individuals, soil, and associated native vegetation; and to prevent or remove invasive, exotic plants within acuña cactus habitat.

Subunit 3b: Cimarron Mountain—Subunit 3b consists of 2,100 ha (5,190

ac) of potential acuña cactus habitat all on land owned by the Tohono O'odham Nation. This unit has not been surveyed for the acuña cactus, and no acuña cacti are known to occur here at the time of listing. Modeling demonstrated that this subunit contains suitable habitat for the species. In addition, the area receives higher mean annual precipitation (greater than 29.7 cm/year (3.82 in/year)), a factor found to be essential for the conservation of the species (see the Acuña Cactus *Physical or Biological Features* section above). Therefore, this subunit provides space for the growth and expansion of the species, particularly in the face of ongoing drought and climate change model predictions, and is essential for the conservation of the species.

Unit 4: Sand Tank Mountains

Unit 4 is located in the Sand Tank Mountains of southwestern Maricopa County, Arizona. This unit consists of two subunits totaling 4,018 ha (9,928 ac), all of which is federally owned land. The Federal land is administered by the BLM and BMGR.

Subunit 4a: Javelina Mountain—Subunit 4a consists of 911 ha (2,251 ac) of land within the Sonoran Desert National Monument administered by the BLM. This subunit contains three separate populations totaling 200 individuals. This subunit contains all of the primary constituent elements of the physical or biological features essential to the conservation of the acuña cactus.

Grazing and mining are not permitted within the Sonoran Desert National Monument and the BMGR; however, off-road border-related activities and trespass livestock grazing may occur in Subunit 4a. Special management considerations or protections may be required within Subunit 4a to address increased off-road border-related human disturbances; to minimize disturbance to acuña cactus individuals, the soil, and associated native vegetation; and to prevent or remove invasive, exotic plants within acuña cactus habitat.

Subunit 4b: Sand Tank Mountain—Subunit 4b consists of 3,107 ha (7,677 ac) of potential acuña cactus habitat within the Sonoran Desert National Monument (140 ha (347 ac)) and the BMGR (2,967 ha (7,331 ac)). This unit has not been surveyed for the acuña cactus, and no acuña cacti are known to occur there at the time of listing. Modeling demonstrated that this subunit contains suitable habitat for the species. The area also receives higher mean annual precipitation (greater than 29.7 cm/year (11.69 in/year)), a factor found to be necessary for the conservation of the species. Therefore, this subunit is essential for the conservation of the acuña cactus because it provides space for the growth and expansion of the species, especially in the face of ongoing drought and climate change model predictions.

Unit 5: Mineral Mountain

Unit 5 consists of 1,092 ha (2,697 ac) on Mineral Mountain of north-central Pinal County, Arizona. This unit contains 874 ha (2,160 ac) of federally owned land and 217 ha (537 ac) of State-owned land. The Federal land is administered by the BLM (873 ha (2,158 ac)) and the Bureau of Reclamation (BOR) (1 ha (2 ac)).

This unit contains five separate known populations totaling at least 30 individuals on lands administered by the BLM and the State of Arizona. This unit contains all of the primary constituent elements of the physical or biological features essential to the conservation of the acuña cactus.

Livestock grazing and ORV activity occur on this unit, and mining occurs nearby. Special management considerations or protections may be required within the unit to minimize habitat fragmentation; to minimize disturbance to acuña cactus individuals, soil, and associated native vegetation; and to prevent or remove invasive, exotic plants within acuña cactus habitat.

Unit 6: Box O Wash

Unit 6 consists of 8,221 ha (20,314 ac) near Box O Wash of north-central Pinal County, Arizona. This unit contains 1,378 ha (3,404 ac) of federally owned land, 5,556 ha (13,729 ac) of State-owned land, and 1,287 ha (3,180 ac) of privately owned land. The Federal land is administered by the BLM (1,058 ha (2,615 ac)) and BOR (320 ha (790 ac)).

This unit contains three separate populations totaling at least 11 individuals. This unit contains all of the primary constituent elements of the physical or biological features essential to the conservation of the acuña cactus.

Livestock grazing and ORV activity occur on this unit, and mining occurs nearby. Special management considerations or protections may be required within the unit to minimize habitat fragmentation; to minimize disturbance to acuña cactus individuals, soil, and associated native vegetation; and to prevent or remove invasive, exotic plants within acuña cactus habitat.

Fickeisen Plains Cactus

Physical or Biological Features

We derive the specific physical or biological features required for the Fickeisen plains cactus from studies of the species' habitat, ecology, and life history as described below. We have determined that the Fickeisen plains cactus requires the following physical and biological features:

Space for Individual and Population Growth, and for Normal Behavior and Food, Water, Air, Light, Minerals or Other Nutritional or Physiological Requirements

The Fickeisen plains cactus is a narrow endemic with a limited distribution in northern Arizona on the Colorado Plateau. Within its range, the Fickeisen plains cactus requires the appropriate soils, associated geologic formations, slope, drainage, and plant community within the landscape to provide space for individual growth and population growth and to provide food, water, air, light, minerals or other nutritional or physiological requirements. The Fickeisen plains cactus is found on soils formed from alluvium, colluvium, or Aeolian deposits derived from limestone of the Harrisburg member of the Kaibab Formation and Toroweap Formation, underlain with Coconino Sandstone, and sandstone and mudstone of the Moenkopi Formation (Billingsley *et al.* 2001, entire; AZGS 2011). Several occurrences are located on or in close proximity to active or quaternary faults.

TABLE 7—SOIL CLASS ASSOCIATED WITH THE FICKEISEN PLAINS CACTUS HABITAT

Soil class associations	Percent slope
Strych very gravelly loam	2–10 percent slope.
Mellenthin-Rock outcrop-Torriorthents complex	10–70 percent slope
Mellenthin-Tanbark complex	5–50 percent slope.
Moenkopie-Goblin complex	5–50 percent slope.
Dutchman-McCullan complex	1–10 percent slope.
Twist sandy loam	2–10 percent slope.

TABLE 7—SOIL CLASS ASSOCIATED WITH THE FICKEISEN PLAINS CACTUS HABITAT—Continued

Soil class associations	Percent slope
Mellenthin very gravelly loam	1–25 percent slope.
Saido-Brinkerhoff complex	1–5 percent slope.
Kinan gravelly loam	1–15 percent slope.
Mellenthin-Progresso complex	1–7 percent slope.
Kinan-Pennell complex	4–15 percent slope.
Pennell cobbly loam	3–10 percent slope.
Pennell gravelly sandy loam	20–45 percent slope.
Monierco clay loam	2–15 percent slope.
Monue-Seeg complex	1–6 percent slope.
Hajisho-Cataract family-Shinume complex	4–15 percent slope.
Hajisho-Seeg complex	2–15 percent slope.
Salten-Meriwhitica-Wayneco-Tassi family, complex	5–30 percent slope.
Winona gravelly loam	0–8 percent slope.
Winon stony loam	0–8 percent slope.
Winon-Boysag gravelly loam	0–8 percent slope.
Winona-Rock outcrop	15–30 percent and 30–70 percent slope.

The Fickeisen plains cactus is affiliated with several soil series across its range (Table 7). The Fickeisen plains cactus is found on nonsaline to slightly saline soils that are shallow to moderately deep; well-drained; and consisting of gravelly loam, fine sandy loam, gravelly sandy loam, clay loam, and cobbly loam (NRCS 2012), with a soil pH between 7.9 to 8.4 (NatureServe 2011; NRCS 2012). The fine textured and very loose soil texture may enable the plant to be completely buried once retracted (NNHP 1994, p. 3), thereby protecting the apex from exposure to low temperatures during the winter season. The Fickeisen plains cactus is found at elevations from 1,310 to 1,813 m (4,200 to 5,950 ft). These elevations support between 15.25 and 35.56 cm (6 to 14 in) of annual rainfall, although precipitation patterns and monthly amounts are highly variable within the range of the Fickeisen plains cactus. Plants are found growing on mesa tops or plateaus and depositional areas consisting of flat terraces and benches, along the margins of canyon rims or on the toe of well-drained hills. Individuals are found on the western, southwestern, and southern-facing exposures with slopes of 0 to 20 percent (Arizona Rare Plant Committee 2001, unpaginated; AGFD 2011a, p. 2), although most plants are observed on slopes less than 10 percent.

The Fickeisen plains cactus occurs within the Plains and Great Basin grasslands and Great Basin desert scrub vegetation communities (Benson 1982, p. 764; NatureServe 2011). Dominate native plant species that are commonly associated with these biotic communities include: *Artemisia tridentata* (sagebrush), *Atriplex canescens* (four-wing saltbush), *Atriplex confertifolia* (shadscale), *Bouteloua eriopoda* (black grama), *Bouteloua gracilis* (blue grama), *Bromus* spp. (brome), *Chrysothamnus* spp. (rabbit-bush), *Ephedra torreyana* (Mormon tea), *Eurotia lanata* (winterfat), *Gutierrezia sarothrae* (broom snakeweed), *Pleuraphis jamesii* (James's galleta), *Oryzopsis hymenoides* (Indian ricegrass), *Sphaeralcea* spp. (globe-mallow), and *Stipa* spp. (needlegrass). Other native cactus species that are commonly found include *Agave utahensis* (century plants), *Echinocactus polycephalus* spp. and *Escobaria vivipara* var. *rosea* (foxtail cactus) (Brown 1994, pp. 115–121; Turner 1994, pp. 145–155; Hughes 1996b, p. 2; Goodwin 2011a, p. 4; NatureServe 2011).

The Fickeisen plains cactus is found growing in open, sparsely vegetated areas in full sun but also in areas of dense grass cover. Seedlings and adult Fickeisen plains cacti observed growing underneath a shrub canopy or from clumps of grama grass appeared to be larger and fuller than those in open areas. Some type and amount of canopy cover may create suitable microhabitat conditions that enhance Fickeisen plains cactus' survival by providing protection from the sun and wind, and by decreasing the rate of evapotranspiration (Milne 1987, p. 34). In order for the Fickeisen plains cactus to produce flower and set seed in the spring, adequate soil moisture during the winter is necessary (Brack 2012, pers. comm.). The general soil moisture recharge period across its range is from December to March (Travis 1987, p. 3), when temperatures and soil evaporation are low. Accumulated soil moisture is usually depleted by the summer months in which the Fickeisen plains cactus will retract underground but may emerge following summer monsoon thunderstorms. Therefore, based on the information presented above, we identify limestone soils derived from the appropriate formations; gravelly, shallow, and well-drained soils; the appropriate elevation range; and adequate precipitation to be essential physical or biological features for this species.

Sites for Breeding, Reproduction, Rearing, Germination, Seed Dispersal or Pollination

The Fickeisen plains cactus does not require areas for breeding or reproduction other than the areas they occupy and any area necessary for pollinators and seed dispersal (refer to Pollination and Pollen Dispersal section in Acuña Cactus above). Reproduction sites accommodate all life-history phases of the Fickeisen plains cactus. Like other native plants within the Colorado Plateau region, adequate precipitation and low temperatures during the winter season, which reduce evaporation, favor seedling germination (Comstock and Ehleringer 1992, pp. 196–199).

The Fickeisen plains cactus is found in areas of sparse vegetation and in tall, dense grass. Seeds of the Fickeisen plains cactus would likely require certain soil conditions to germinate, such as adequate amounts of soil moisture and nutrients, and temperatures conducive to germination, but we do not have any information regarding those specific requirements. Seed production in the Fickeisen plains cactus is considered to be low (Hughes 2011, pers. comm.), and most species of *Pediocactus* have poor seed dispersal mechanisms (Benson 1982, p. 750). Seedlings are often observed near the parent plant (Goodwin 2011a, p. 9) and do better when shade is provided by a

parent or nurse rock (Nobel 1984, p. 316; Milne 1987, p. 34). The Fickeisen plains cactus relies solely on the production of seed for reproduction (Pimienta-Barrios and del Castillo 2002, p. 79). Optimal seed set occurs through visitation and pollination by native bees.

Pollinators observed visiting flowers of the Fickeisen plains cactus include hover flies (family Syrphidae), bee flies (family Bombyliidae), mining bees (family Andrenidae), and sweat bees (family Halictidae) (Milne 1987, p. 21; NNHP 1994, p. 3). However, the primary pollinators for the Fickeisen plains cactus are believed to be halictid bees from the genera *Lasioglossum, Halictus,* and *Agapostemon,* based on several studied species of *Pediocactus* (Tepedino 2012, pers. comm.). Additionally, although flies may pollinate flowers of the Fickeisen plains cactus when they eat pollen or nectar, bees are considered to be the essential pollinators for native plants and likely for the Fickeisen plains cactus. Foraging distances vary by species and body size (Greenleaf *et al.* 2007, p. 592*),* but the typical flight distances of halictid bees in the genera *Lasioglossum* are 10 to 410 m (33 to 1,345 ft). The foraging distance for the largest bodied bee in the genera *Agapostemon* is approximately 1,000 m (3,280 ft) (Tepedino 2012, pers. comm.).

For the Fickeisen plains cactus, because of its endemism, small population size, and disjunct occurrence, maintaining genetic diversity is essential for its persistence (Tepedino *et al.* 1996, p. 245). In general, maintaining adequate populations of the Fickeisen plains cactus' primary pollinators, which likely depends on the presence and diversity of other native plant species in sufficient numbers within, near, and between populations (''stepping stones''), is essential to facilitate gene flow (NatureServe 2011). Therefore, maintaining areas with a high diversity of native plant species is necessary to sustain populations of native pollinators (Peach *et al.* 1993, p. 314). Low numbers of abundant flowers offering little reward can lead to low rates of plants visited by pollinators (Wilcox and Neiland 2002, pp. 272–273). The Fickeisen plains cactus relies solely on the production of seeds for reproduction, with pollination highly linked to their survival. A lack of pollinators would gradually decrease the number of seeds in the seed bank and the conservation potential for the Fickeisen plains cactus (Wilcock and Neiland 2002, p. 276). Therefore, based on the information above, we identify a pollination area-with a radius of 1,000 m (3,280 ft) around each reproducing Fickeisen plains cactus and containing native vegetation as a physical or biological feature of Fickeisen plains cactus habitat.

Habitats That are Protected From Disturbance or Representative of the Historical, Geographical, and Ecological Distribution of the Species

The Fickeisen plains cactus has a restricted geographical distribution. Endemic species whose populations exhibit a high degree of isolation are extremely susceptible to extinction from random and non-random, catastrophic, natural or human-caused events. Therefore, the conservation of the Fickeisen plains cactus is dependent on several factors, including but not limited to: (1) Maintenance of areas of sufficient size and configuration to sustain natural ecosystem components, functions, and processes (such as sun exposure, native shrubs or grasses that provide microhabitats for seedlings, natural fire and hydrologic regimes, preservation of biological soil crusts that support the surrounding vegetation community, and adequate biotic balance to prevent excessive herbivory); (2) protection of the existing substrate continuity and structure; (3) connectivity among clusters of plants within geographic proximity to facilitate gene flow among these sites through pollination activity and seed dispersal; and (4) sufficient adjacent suitable habitat for reproduction and population expansion.

A natural, generally intact surface and subsurface that is free of inappropriate disturbance associated with land use activities (such as trampling and soil compaction from livestock grazing) and associated physical processes such as the hydrologic regime are necessary to provide water, minerals, and other physiological needs for the Fickeisen plains cactus. A natural intact surface and subsurface includes the preservation of soil qualities (texture, slope, rooting depth) to enable the seasonal ability of plants to retract below the subsurface to enter dormancy but emerge when conditions are favorable. A natural hydrologic regime includes the seasonal retention of soil moisture followed by the drying out of the substrate to promote growth of plants for the following season. These processes enable populations to develop and maintain seed banks, and to provide for success seedling survival, adult growth, and expansion of populations. The Fickeisen plains cactus must sustain and expand in number if ecological representation of this species is to be ensured. Therefore, based on the information above, we identify natural, generally intact surface and subsurface that preserves the physical processes, such as soil quality and the natural hydrology of a natural vegetation community, to be physical or biological features for this species.

Primary Constituent Elements for the Fickeisen Plains Cactus

Based on our current knowledge of the physical or biological features and habitat characteristics required to sustain the species' life-history processes, we determine that the primary constituent elements specific to the Fickeisen plains cactus are:

(i) Soils in northern Arizona on the Colorado Plateau that are:

a. Formed from alluvium, colluvium, or Aeolian deposits;

b. Derived from limestone of the Harrisburg member of the Kaibab Formation and Toroweap Formation;

c. Underlain with Coconino Sandstone, and sandstone and mudstone of the Moenkopi Formation;

d. At an elevation of 1,310 to 1,813 m (4,200 to 5,950 ft);

e. Are gravelly-loam, fine-textured, well drained, and shallow;

f. On terraces, benches, tops of mesas and plateaus, toe-slope of hills with a 0 to 20 percent slope;

g. Supportive of biological soil crusts;

h. Within the Plains and Great Basin grassland and Great Basin desert scrub vegetation communities;

(ii) Native vegetation in areas that have natural, generally intact surface and subsurface features that provide habitat and suitable nesting substrate for the cactus' pollinators and space for seed dispersal and germination; and

(iii) Provide for pollinator habitat with a radius of 1,000 m (3,280 ft) around each individual, reproducing Fickeisen plains cactus.

Special Management Considerations or Protection

When designating critical habitat, we assess whether the specific areas within the geographical area occupied by the species at the time of listing contain features which are essential to the conservation of the species and which may require special management considerations or protection. The features essential to the conservation of this species may require special management considerations or protection to reduce the following threats: (1) Livestock grazing; (2) nonnative, invasive plant species; (3) rodent and rabbit predation; and (4) long-term drought. Special management considerations or protection are required within critical habitat areas to

address these threats. Management activities that could ameliorate these threats include (but are not limited to) improving habitats and potentially increasing plant population numbers on lands the BLM, Forest Service, or the State currently holds or may hold in the future. Special management to protect the features essential to the conservation of the species include conservation measures and actions to minimize effects of livestock grazing; control nonnative, invasive plants; reduce rodent and rabbit predation, and manage activities in response to drought conditions on these lands. These management activities will protect the features essential to the conservation of the species by maintaining native vegetation communities, preserving soil characteristics, and providing habitat for the Fickeisen plains cactus and its pollinators.

Criteria Used To Identify Critical Habitat

As required by section 4(b)(2) of the Act, we use the best scientific data available to designate critical habitat. We review available information pertaining to the habitat requirements of the species. In accordance with the Act and its implementing regulation at 50 CFR 424.12(e), we consider whether designating additional areas—outside those currently occupied as well as those occupied at the time of listing—are necessary to ensure the conservation of the species. We have determined that all areas we are proposing to designate as critical habitat are within the geographical area occupied by the species at the time of listing (see the ''Abundance and Trends'' section, above, for more information).

Based on the best available information, we conclude that the nine proposed units are occupied by the Fickeisen plains cactus. We acknowledge that several of the populations have not been visited for many years, but our rationale for including them within occupied units is described below.

The Salaratus Draw (which includes Salaratus Draw I and Salaratus Draw II) and Toquer Tank sites were within the BLM's ''seldom'' monitored cluster plots and contain a few, widely spaced individuals. These cluster plots were for the purpose of tracking presence or absence and not intended to be intensively searched or to establish a population estimate. They were originally created to be visited every 5 to 10 years in which, the Toquer Tank plot was last visited in 1994 and the Salaratus Draw plots in 2001. We have very little information about the Fickeisen plains cactus in the Toquer Tank plot. A fair number of plants were documented there for several consecutive years and the site was occupied in 1994. When the Salaratus Draw plots were last visited in 2001, the sites were reported to be dry. Climate data for 2001 recorded below-average precipitation, and the region was experiencing a prolonged drought. Given that the Fickeisen plains cactus can be difficult to locate, particularly when plants are not flowering, it is likely that they were retracted below ground and missed during the count. In addition, plants may remain underground for several years in a row, as has been documented in the plots that are regularly monitored by the BLM. Even plants that have their crown exposed just above the soil surface can be difficult to locate. When conditions are ideal (adequate precipitation), plants will emerge above ground and are easier to detect. Additionally, BLM documented one instance when the Sunshine Ridge population had declined to zero plants in 2000, but three of the tagged plants were detected the following year. This provides basis for our assumption that the Salaratus Draw and Toquer Tank may still be occupied as of 2012.

Furthermore, the Fickeisen plains cactus was documented at six sites that have never been monitored and have not been visited in over 18 years. These unmonitored sites (Beanhole Well, Marble Canyon, South Canyon, Tiger Wash1, Tiger Wash 2, and Shinumo Wash) are within 6 km (4 mi) of the monitored sites in House Rock Valley where the Fickeisen plains cactus has been documented within the last 6 years. Livestock grazing has been reported in the area of the South Canyon site, but there is no evidence that the grazing resulted in the Fickeisen plains cactus being removed from the population. Similarly, there have been no large-scale, surface-disturbing activities occurring in proximity to the monitored or unmonitored areas that would lead us to believe that the Fickeisen plains cactus is no longer viable at the sites. Also, the life span of the Fickeisen plains cactus is estimated to be between 10 to 15 years (Phillips *et al.* 1982, p. 9). Because these six unmonitored sites are within close proximity to the monitored sites that contain the Fickeisen plains cactus, the environmental conditions have not been severe enough to extirpate the cactus from nearby monitored sites, impacts to the habitat from livestock grazing have not removed plants from the monitored populations, and the cactus has a lifespan of 10 to 15 years, we believe that the six unmonitored subunits are still occupied by the Fickeisen plains cactus.

To further our assumption that unsurveyed areas may still be occupied, the Fickeisen plains cactus exhibits episodic recruitment when climatic conditions are ideal. Based on BLM's monitoring information, a few small plants do emerge, perhaps not each year, but at least every 2 to 4 years. Information that describes the habitat of these sites is very limited. Livestock grazing is the primary surface-disturbing activity. Based on our evaluation of grazing for the regular monitored plots, we anticipate that the habitat has been degraded and impacted by other identified threats to the plant. We also acknowledge that these small populations are being affected by drought and climate change, and when coupled with surface disturbance, this likely results in increased mortality. But based on the best available information, there is no indication that leads us to believe that the Fickeisen plains cactus is no longer viable at the unsurveyed sites.

We considered areas outside the geographical area occupied by the Fickeisen plains cactus at the time of listing, but we are not proposing to designate any areas outside the geographical area occupied by the Fickeisen plains cactus. In our review, the Fickeisen plains cactus occurs across a broad range with different topography, large elevational gradients, and vegetation communities (Grahame and Sisk 2002, entire; USGS 2002, entire). Due to the vastness and diversity of the range, there are areas within its geographical range that provides for *in-situ* conservation if needed in the future. Therefore, we determined that a subset of occupied lands within the species' current range is adequate to ensure the conservation of the Fickeisen plains cactus.

We reviewed available information and supporting data that pertains to the habitat requirements of the Fickeisen plains cactus. This information included research published in peer-reviewed articles, soil surveys, agency reports, special land assessments, and data collected from long-term monitoring plots, interviews with experts, and regional climate data and GIS coverage. Sources of information include, but are not limited to: AGFD 2011b, AZGS 2011, Billingsley 2000, Billingsley and Dyer 2003, BLM 2007a, Calico 2012, Goodwin 2011a, Hazelton 2012a, Milne 1987, NNHP 2011a, NRCS 2012, Phillips *et al.* 1982, Travis 1987, and WRCC 2012. Based on this

information, we developed a strategy for determining which areas meet the definition of critical habitat for the Fickeisen plains cactus.

In identifying proposed critical habitat units for the Fickeisen plains cactus, we proceeded through a multi-step process. We obtained all records for the distribution of the Fickeisen plains cactus from AGFD, as well as both published and unpublished documentation from our files. Recent survey results confirm that plant distribution is similar to known distributions with the exception that additional populations have been found following survey efforts.

Our approach to delineating critical habitat units was applied in the following manner:

(1) We overlaid locations of the Fickeisen plains cactus into a GIS database. This provided us with the ability to examine slope, elevation, geologic type, vegetation community, and topographic features. These data points verified and slightly expanded the previously recorded elevation ranges for the Fickeisen plains cactus.

(2) In addition to the GIS layers listed above, we then included a 1,000 m (3,280 ft) pollination area around known populations to encompass native vegetation surrounding individual Fickeisen plains cacti, as described in *Primary Constituent Elements for the Fickeisen Plains Cactus,* above.

(3) We then drew critical habitat boundaries that captured the locations elucidated under (1) and (2) above. Critical habitat designations were then mapped using Albers Equal Area (Albers) North American Datum 83 (NAD 83) coordinates.

Occupied Area at the Time of Listing

Areas where plants are or have been documented within the species' described range were considered to be occupied at the time of listing. The known range of the Fickeisen plains cactus is from Mainstreet Valley and Hurricane Valley in Mohave County to House Rock Valley in Coconino County on the Arizona Strip; along the canyon rims of the Colorado River and Little Colorado River, to the area of Gray Mountain; and along the rims of Cataract Canyon on the Coconino Plateau.

Occupied occurrences of the Fickeisen plains cactus located in close proximity were grouped into one unit (e.g., Hurricane Cliffs). Areas where plants are distributed over a large distance (e.g., Cataract Ranch) were also categorized into one unit. All of the units contained all of the identified elements of physical or biological features and supported multiple life-history processes.

The critical habitat designation is defined by the map or maps, as modified by any accompanying regulatory text, presented at the end of this document in the rule portion. We include more detailed information on the boundaries of the critical habitat designation in the preamble of this document. We will make the coordinates or plot points or both on which each map is based available to the public on *http://www.regulations.gov* at Docket No. FWS–R2–ES–2012–0061, on our Internet sites *http://www.fws.gov/southwest/es/arizona/,* and at the field office responsible for the designation (see **FOR FURTHER INFORMATION CONTACT** above).

Proposed Critical Habitat Designation for the Fickeisen Plains Cactus

We are proposing nine units as critical habitat for the Fickeisen plains cactus. The critical habitat areas we describe below constitute our current best assessment of areas that meet the definition of critical habitat for the Fickeisen plains cactus. The nine areas we propose as critical habitat are: (1) Hurricane Cliffs; (2) Sunshine Ridge; (3) Clayhole Valley; (4) Snake Gulch; (5) House Rock Valley; (6) Tiger Wash; (7) Little Colorado River Overlook; (8) Gray Mountain; and (9) Cataract Canyon. All of the nine critical habitat units are occupied by the Fickeisen plains cactus.

The approximate area of each proposed critical habitat unit is shown in Table 8.

TABLE 8—PROPOSED CRITICAL HABITAT UNITS FOR THE FICKEISEN PLAINS CACTUS

Unit	Subunit	Federal	State	Tribal	Private	Total
		Ha (Ac)	Ha (Ac)	Ha (Ac)	Ha (Ac)	Ha (Ac)
1. Hurricane Cliffs	Dutchman Draw	1,525 (3,769)	0	0	2 (5)	1,527 (3,774)
	Salaratus Draw	445 (1,098)	266 (658)	0	13 (33)	724 (1,789)
	Temple Trail	443 (1,096)	0	0	0	443 (1,096)
	Toquer Tank	350 (865)	0	0	0	350 (865)
Unit Total	.....	2,763 (6,828)	266 (658)	0	15 (38)	3,044 (7,524)
2. Sunshine Ridge	Sunshine Ridge	612 (1,512)	142 (351)	0	0	754 (1,863)
3. Clayhole Valley	Clayhole Ridge	338 (836)	76 (188)	0	0	414 (1,024)
4. Snake Gulch	Snake Gulch	945 (2,335)	0	0	0	945 (2,335)
5. House Rock Valley	Beanhole Well	745 (1,841)	126 (312)	0	0	871 (2,153)
	North Canyon Wash	472 (1,166)	0	0	0	472 (1,166)
	Marble Canyon	214 (528)	0	0	0	214 (528)
	South Canyon	336 (831)	0	0	0	336 (831)
Unit Total	.....	1,767 (4,366)	126 (312)	0	0	1,893 (4,678)
6. Tiger Wash	Tiger Wash 1	0	0	380 (940)	0	380 (940)
	Tiger Wash 2	0	0	1,497 (3,700)	0	1,497 (3,700)
	Shinumo Wash	0	0	380 (940)	0	380 (940)
Unit Total	.....	0	0	2,257 (5,580)	0	2,257 (5,580)

TABLE 8—PROPOSED CRITICAL HABITAT UNITS FOR THE FICKEISEN PLAINS CACTUS—Continued

Unit	Subunit	Federal	State	Tribal	Private	Total
		Ha (Ac)	Ha (Ac)	Ha (Ac)	Ha (Ac)	Ha (Ac)
7. Little Colorado River (LCR) Overlook	LCR Overlook	0	0	1,170 (2,891)	0	1,170 (2,891)
8. Gray Mountain	Mays Wash	246 (609)	80 (198)	0 0	371 (917)	697 (1,724)
	Gray Mountain	0	7 (17)	438 (1,083)	514 (1,271)	960 (2,371)
Unit Total		246 (609)	87 (215)	438 (1,083)	885 (2,188)	1,656 (4,095)
9. Cataract Canyon	Cataract Canyon	0	4,920 (12,159)	0 0	2,848 (7,037)	7,768 (19,196)
Grand Total		6,671 (16,486)	5,617 (13,883)	3,865 (9,554)	3,748 (9,263)	19,901 (49,186)

Note: Area sizes may not sum due to rounding.

We present below brief descriptions of all units, and reasons why they meet the definition of critical habitat for the Fickeisen plains cactus.

Unit 1: Hurricane Cliffs

The Hurricane Cliffs Unit is located within the Hurricane Cliffs geographic area that is bounded to the west by Mainstreet Valley and to the east by Hurricane Cliffs. The unit consists of four subunits totaling 3,044 ha (7,524 ac) on the Arizona Strip in Mohave County. The unit includes private land, lands owned by the State of Arizona, and federally owned land managed by the BLM. This subunit contains all of the primary constituent elements of the physical or biological features essential to the conservation of the Fickeisen plains cactus. Occupancy of the Hurricane Cliffs Unit by the Fickeisen plains cactus has been documented since 1986 (BLM 1986, p. 1). The species was considered generally rare but in abundant numbers at Dutchman Draw with scattered individuals located in small clusters adjacent to the Dutchman Draw populations. These smaller clusters include the Navajo, Ward, Salaratus Draw I and Salaratus Draw II, Temple Trail, and Toquer Tank populations.

Subunit 1a: Dutchman Draw—Subunit 1a consists of 1,527 ha (3,774 ac) in Mainstreet Valley next to Dutchman Draw. Lands within this subunit are occupied at the time of listing. This site has been monitored regularly since 1986, and contains 12 plants as of 2011. This subunit also includes the Navajo and Ward cluster plots. These small plots were last visited in 2001 and 10 plants were found at both of the sites. This subunit contains all of the primary constituent elements of the physical or biological features essential to the conservation of the Fickeisen plains cactus.

Subunit 1b: Salaratus Draw—Subunit 1b consists of 724 ha (1,789 ac) in Mainstreet Valley. Lands within this subunit are occupied at the time of listing. This site was visited only three times between 1986 and 2001. This subunit includes Salaratus Draw I and Salaratus Draw II populations. At most, 44 plants were located in these areas in 19994. This subunit contains all of the primary constituent elements of the physical or biological features essential to the conservation of the Fickeisen plains cactus.

Subunit 1c: Temple Trail—Subunit 1c consists of 443 ha (1,096 ac) in Lower Hurricane Valley. Lands within this subunit are occupied at the time of listing. This site was last visited in 2001 when seven individuals were found. This subunit contains all of the primary constituent elements of the physical or biological features essential to the conservation of the Fickeisen plains cactus.

Subunit 1d: Toquer Tank—Subunit 1d consists of 350 ha (865 ac) in Mainstreet Valley. Lands within this subunit are occupied at the time of listing. This site was regularly monitored from 1986 to 1991, when abundance counts ranged from 7 to 13 plants. This site was last visited in 1994 and seven individuals were found. This subunit contains all of the primary constituent elements of the physical or biological features essential to the conservation of the Fickeisen plains cactus.

In all subunits of Unit 1, the features essential to the conservation of the species may require special management considerations to address threats from livestock grazing; nonnative, invasive species; rodent or rabbit predation, and long-term drought.

Unit 2: Sunshine Ridge Unit

The unit includes lands owned by the State and federally owned land that is managed by the BLM. Plants are located east of the Uinkaret Plateau and east of the range of the *Pediocactus sileri* (Siler pincushion cactus). Occupancy of the Sunshine Ridge Unit by the Fickeisen plains cactus has been documented since 1977 (AGFD 2011b, entire). This population has been regularly monitored since 1986, and has 34 plants as of 2011. Land within this unit is occupied at the time of listing and contains all of the primary constituent elements of the physical or biological features essential to the conservation of the Fickeisen plains cactus.

The features essential to the conservation of the species may require special management considerations to address threats from livestock grazing; nonnative, invasive species; rodent or rabbit predation, and long-term drought.

Unit 3: Clayhole Valley

Unit 3 is located in Upper Clayhole Valley on the Uinkaret Plateau. The unit consists of the Clayhole Ridge subunit totaling 414 ha (1,024 ac) on the Arizona Strip in Mohave County. The unit includes land owned by the State and federally owned land that is managed by the BLM. Occupancy of the Clayhole Valley Unit by the Fickeisen plains cactus has been documented since 1980 (AGFD 2011b, entire). The population has been monitored annually since 1986. As of 2011, the population contains 42 plants. Land within this unit is occupied at the time of listing and contains all of the primary constituent elements of the physical or biological features essential to the conservation of the Fickeisen plains cactus.

The features essential to the conservation of the species may require

special management considerations to address threats from livestock grazing; nonnative, invasive species; rodent or rabbit predation, and long-term drought.

Unit 4: Snake Gulch Unit

Unit 4 is located on the western boundary of the Kaibab National Forest in Coconino County. The unit consists of 945 ha (2,335 ac) on the North Kaibab Ranger District. The entire unit consists of federally owned land that is managed by the U.S. Forest Service. Occupancy was confirmed in 2004, by the Kaibab National Forest. The number of plants occurring here has not been documented except in general terms of presence/absence. This unit is occupied at the time of listing and contains all of the primary constituent elements of the physical or biological features essential to the conservation of the Fickeisen plains cactus.

The features essential to the conservation of the species may require special management considerations to address threats from nonnative, invasive species and long-term drought. Livestock grazing is permitted in this subunit during the winter, but is not considered a threat to the features essential to the conservation of the Fickeisen plains cactus.

Unit 5: House Rock Valley

Unit 5 is located on the eastern edge of the Arizona Strip in Coconino County and near the North Rim of the Grand Canyon National Park. The unit consists of four subunits totaling 1,893 ha (4,678 ac). The unit consists of land owned by the State and federally owned land that is managed by the BLM. Lands within this unit are occupied at the time of listing and contain all of the primary constituent elements of the physical or biological features essential to the conservation of the Fickeisen plains cactus.

Occupancy of the Fickeisen plains cactus in the House Rock Valley Unit was first documented in 1979 (Phillips 1979, entire; AGFD 2011b, entire), at Beanhole Well, Marble Canyon, and South Canyon. These sites have not been visited for many years. However, we have no reason to believe these sites are not occupied at the time of listing for the before-mentioned reasons. Occupancy at the North Canyon Wash site was documented in 1986, and it has been regularly monitored. The House Rock Valley Unit is bounded by the Colorado River that runs northwest to southwest, U.S. Highway 89A to the north, and the Kaibab National Forest to the west.

Subunit 5a: Beanhole Well—Subunit 5a consists of 745 ha (1,841 ac) of federally owned land that is managed by the BLM, and 126 ha (312 ac) of State-owned land. Lands within this subunit are occupied at the time of listing. Three plants were documented at Beanhole Well in 1979, and the site has been visited since then, but we do not have information available regarding numbers of plants. This subunit contains all of the primary constituent elements of the physical or biological features essential to the conservation of the Fickeisen plains cactus.

Subunit 5b: North Canyon Wash—Subunit 1b consists of 472 ha (1,166 ac) of federally owned land that is managed by the BLM. Lands within this subunit are occupied at the time of listing. This site has been regularly monitored since 1986. As of 2011, the site contains 39 Fickeisen plains cactus. This subunit contains all of the primary constituent elements of the physical or biological features essential to the conservation of the Fickeisen plains cactus.

Subunit 5c: Marble Canyon—Subunit 5c consists of 214 ha (528 ac) of federally owned land that is managed by the BLM. Lands within this subunit are occupied at the time of listing. Eight plants were documented at Marble Canyon in 1979. This site has not been visited for many years. This subunit contains all of the primary constituent elements of the physical or biological features essential to the conservation of the Fickeisen plains cactus.

Subunit 5d: South Canyon—Subunit 5d consists of 336 ha (831 ac) of Federal Land in House Rock Valley along the rim of Marble Canyon. Lands within this subunit are occupied at the time of listing. A total of 52 plants have been documented at this site historically. This subunit contains all of the primary constituent elements of the physical or biological features essential to the conservation of the Fickeisen plains cactus.

In all subunits of Unit 5, the features essential to the conservation of the species may require special management considerations to address threats from livestock grazing; nonnative, invasive species; rodent and rabbit predation, and long-term drought.

Unit 6: Tiger Wash

Unit 6 is located near the rim of Marble Canyon on the Navajo Nation. The unit consists of three subunits totaling 2,257 ha (5,580 ac) in Coconino County. The entire unit is managed by the Navajo Nation. Occupancy of the Tiger Wash Unit by the Fickeisen plains cactus was first documented in 1991 (NNHP 2011a, p. 3). At that time, it contained 41 plants that were observed to be in good-to-excellent condition and reproductive (NNHP 1994, p. 6). We will coordinate with the Tribe and examine what conservation actions, management plans, and commitments and assurances for the Fickeisen plains cactus occur on these lands for potential exclusion from the final designation of critical habitat under section 4(b)(2) of the Act.

Subunit 6a: Tiger Wash 1—Subunit 6a consists of 380 ha (940 ac) on the Navajo Nation near the Marble Canyon. Lands within this subunit are occupied at the time of listing. This site was visited in 2005, and two plants were found. This subunit contains all of the primary constituent elements of the physical or biological features essential to the conservation of the Fickeisen plains cactus.

Subunit 6b: Tiger Wash 2—Subunit 6b consists of 1,497 ha (3,700 ac) on the Navajo Nation near the Marble Canyon. Lands in this subunit are considered occupied at the time of listing. This site was visited in 1993, when 11 plants were found among 3 areas within this site. This subunit contains all of the primary constituent elements of the physical or biological features essential to the conservation of the Fickeisen plains cactus.

Subunit 6c: Shinumo Wash—Subunit 6c consists of 380 ha (940 ac) on the Navajo Nation near the Marble Canyon. This subunit is considered occupied at the time of listing. This site was visited in 1993, and seven plants were found. This subunit contains all of the primary constituent elements of the physical or biological features essential to the conservation of the Fickeisen plains cactus.

In all subunits of Unit 6, the features essential to the conservation of the species may require special management considerations to address threats from livestock grazing, nonnative, invasive species, and long-term drought.

Unit 7: Little Colorado River Overlook

Unit 7 is located on the rim of the Little Colorado River on the Navajo Nation in Coconino County. The unit consists of 1,170 ha (2,891 ac). The entire unit is managed by the Navajo Nation. Lands in this subunit are considered occupied at the time of listing. Occupancy of the Little Colorado River Overlook Unit by the Fickeisen plains cactus has been documented since 1956 (AGFD 2011b, entire; NNHP 2011a, p. 3). This unit was visited between 1997 and 2005, and a total of 36 plants have been documented among three areas. This unit contains all of the primary constituent elements of the physical or biological features essential

to the conservation of the Fickeisen plains cactus. We will coordinate with the Tribe and examine what conservation actions, management plans, and commitments and assurances for the Fickeisen plains cactus occur on these lands for potential exclusion from the final designation of critical habitat under section 4(b)(2) of the Act.

The features essential to the conservation of the species may require special management considerations to address threats from livestock grazing, nonnative, invasive species, and long-term drought.

Unit 8: Gray Mountain

Unit 8 is located in the vicinity of Gray Mountain in Coconino County. The unit consists of two subunits totaling 1,656 ha (4,095 ac). The unit includes private land, lands owned by the State, tribal lands, and federally owned land managed by the BLM. Lands within this unit are considered occupied at the time of listing. Occupancy at the Gray Mountain unit was first documented in 1962, and consists of two very small populations on both sides Highway 89 near the town of Gray Mountain. This unit contains all of the primary constituent elements of the physical or biological features essential to the conservation of the Fickeisen plains cactus. Portions of the Gray Mountain subunit occur on the Navajo Nation. We will coordinate with the Tribe and examine what conservation actions, management plans, and commitments and assurances for the Fickeisen plains cactus occur on these lands for potential exclusion from the final designation of critical habitat under section 4(b)(2) of the Act.

Subunit 8a: Mays Wash—Subunit 8a consists of 697 ha (1,724 ac) near the near the town of Gray Mountain. The unit includes private land, land owned by the State, and federally owned land managed by the BLM. Lands in this subunit are considered occupied at the time of listing. Occupancy at this site was documented in 1981 and 1984, when 31 plants were found (AGFD 2011b, entire). This subunit contains all of the primary constituent elements of the physical or biological features essential to the conservation of the Fickeisen plains cactus.

Subunit 8b: Gray Mountain—Subunit 8b consists of 960 ha (2,371 ac) on near the near the town of Gray Mountain. This unit includes private land, tribal land, and land owned by the State. Lands in this subunit are considered occupied at the time of listing. Occupancy was last documented in 2009 and three individuals were found (NNHP 2011a, p. 2). This subunit contains all of the primary constituent elements of the physical or biological features essential to the conservation of the Fickeisen plains cactus.

In all subunits of Unit 8, the features essential to the conservation of the species may require special management considerations to address threats from livestock grazing, nonnative, invasive species, and long-term drought.

Unit 9: Cataract Canyon

Unit 9 is located along the Cataract Canyon drainage, a tributary of the Colorado River, on the Coconino Plateau. The unit consists of the Cataract Canyon population totaling 7,768 ha (19,196 ac) and includes private land and land owned by State. The private parcels are within a conservation easement and are referred to as the Cataract Natural Reserve Land (TNC 2000, p. 22). Lands in this unit are considered occupied at the time of listing. Occupancy of the Cataract Canyon Unit by the Fickeisen plains cactus was documented between 2006 and 2011 (Goodwin 2006, pp. 5–7; Goodwin 2008, pp. 8–10; Goodwin 2011a, pp. 18–20). There are 146 plants on private lands, and 161 plants on State land. The unit contains all of the primary constituent elements of the physical or biological features essential to the conservation of the Fickeisen plains cactus.

The features essential to the conservation of the species may require special management considerations to address threats from nonnative, invasive species.

Effects of Critical Habitat Designation for Acuña Cactus and Fickeisen Plains Cactus

Section 7 Consultation

Section 7(a)(2) of the Act requires Federal agencies, including the Service, to ensure that any action they fund, authorize, or carry out is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of designated critical habitat of such species. In addition, section 7(a)(4) of the Act requires Federal agencies to confer with the Service on any agency action which is likely to jeopardize the continued existence of any species proposed to be listed under the Act or result in the destruction or adverse modification of proposed critical habitat.

Decisions by the 5th and 9th Circuit Courts of Appeals have invalidated our regulatory definition of ''destruction or adverse modification'' (50 CFR 402.02) (see *Gifford Pinchot Task Force* v. *U.S. Fish and Wildlife Service,* 378 F.3d 1059 (9th Cir. 2004) and *Sierra Club* v. *U.S. Fish and Wildlife Service et al.,* 245 F.3d 434, 442 (5th Cir. 2001)), and we do not rely on this regulatory definition when analyzing whether an action is likely to destroy or adversely modify critical habitat. Under the statutory provisions of the Act, we determine destruction or adverse modification on the basis of whether, with implementation of the proposed Federal action, the affected critical habitat would continue to serve its intended conservation role for the species.

If a Federal action may affect a listed species or its critical habitat, the responsible Federal agency (action agency) must enter into consultation with us. Examples of actions that are subject to the section 7 consultation process are actions on State, Tribal, local, or private lands that require a Federal permit (such as a permit from the U.S. Army Corps of Engineers under section 404 of the Clean Water Act (33 U.S.C. 1251 *et seq.*) or a permit from the Service under section 10 of the Act) or that involve some other Federal action (such as funding from the Federal Highway Administration, Federal Aviation Administration, or the Federal Emergency Management Agency). Federal actions not affecting listed species or critical habitat, and actions on State, Tribal, local, or private lands that are not federally funded or authorized, do not require section 7 consultation.

As a result of section 7 consultation, we document compliance with the requirements of section 7(a)(2) through our issuance of:

(1) A concurrence letter for Federal actions that may affect, but are not likely to adversely affect, listed species or critical habitat; or

(2) A biological opinion for Federal actions that may affect, or are likely to adversely affect, listed species or critical habitat.

When we issue a biological opinion concluding that a project is likely to jeopardize the continued existence of a listed species and/or destroy or adversely modify critical habitat, we provide reasonable and prudent alternatives to the project, if any are identifiable, that would avoid the likelihood of jeopardy and/or destruction or adverse modification of critical habitat. We define ''reasonable and prudent alternatives'' (at 50 CFR 402.02) as alternative actions identified during consultation that:

(1) Can be implemented in a manner consistent with the intended purpose of the action,

(2) Can be implemented consistent with the scope of the Federal agency's legal authority and jurisdiction,

(3) Are economically and technologically feasible, and

(4) Would, in the Director's opinion, avoid the likelihood of jeopardizing the continued existence of the listed species and/or avoid the likelihood of destroying or adversely modifying critical habitat.

Reasonable and prudent alternatives can vary from slight project modifications to extensive redesign or relocation of the project. Costs associated with implementing a reasonable and prudent alternative are similarly variable.

Regulations at 50 CFR 402.16 require Federal agencies to reinitiate consultation on previously reviewed actions in instances where we have listed a new species or subsequently designated critical habitat that may be affected and the Federal agency has retained discretionary involvement or control over the action (or the agency's discretionary involvement or control is authorized by law). Consequently, Federal agencies sometimes may need to request reinitiation of consultation with us on actions for which formal consultation has been completed, if those actions with discretionary involvement or control may affect subsequently listed species or designated critical habitat.

Application of the ''Adverse Modification'' Standard

The key factor related to the adverse modification determination is whether, with implementation of the proposed Federal action, the affected critical habitat would continue to serve its intended conservation role for the species. Activities that may destroy or adversely modify critical habitat are those that alter the physical or biological features to an extent that appreciably reduces the conservation value of critical habitat for the acuña cactus or for the Fickeisen plains cactus. As discussed above, the role of critical habitat is to support life-history needs of the species and provide for the conservation of the species.

Section 4(b)(8) of the Act requires us to briefly evaluate and describe, in any proposed or final regulation that designates critical habitat, activities involving a Federal action that may destroy or adversely modify such habitat, or that may be affected by such designation.

Activities that may affect critical habitat, when carried out, funded, or authorized by a Federal agency, should result in consultation for the acuña cactus or the Fickeisen plains cactus. These activities include, but are not limited to, actions that would adversely affect the composition and structure of soil within the designated critical habitat for acuña cactus or the Fickeisen plains cactus through land disturbances that result in soil compaction or erosion, removal or degradation of native vegetation, or fragmentation of the acuña cactus or the Fickeisen plains cactus populations or their pollinators. Such activities within the designated critical habitat for acuña cactus or the Fickeisen plains cactus could include, but are not limited to, road and trail building; construction of new border control facilities, towers or fences; mining; ORV activity; cattle or burro grazing; and permitting actions that would result in any of the above effects. These activities could result in the loss of individuals or populations through reduction in productivity, the depletion of seedbanks, or the destruction or degradation of habitat for these cacti or their pollinators.

Exemptions

Application of Section 4(a)(3) of the Act

The Sikes Act Improvement Act of 1997 (Sikes Act) (16 U.S.C. 670a) required each military installation that includes land and water suitable for the conservation and management of natural resources to complete an integrated natural resources management plan (INRMP) by November 17, 2001. An INRMP integrates implementation of the military mission of the installation with stewardship of the natural resources found on the base. Each INRMP includes:

(1) An assessment of the ecological needs on the installation, including the need to provide for the conservation of listed species;

(2) A statement of goals and priorities;

(3) A detailed description of management actions to be implemented to provide for these ecological needs; and

(4) A monitoring and adaptive management plan.

Among other things, each INRMP must, to the extent appropriate and applicable, provide for fish and wildlife management; fish and wildlife habitat enhancement or modification; wetland protection, enhancement, and restoration where necessary to support fish and wildlife; and enforcement of applicable natural resource laws.

The National Defense Authorization Act for Fiscal Year 2004 (Pub. L. 108–136) amended the Act to limit areas eligible for designation as critical habitat. Specifically, section 4(a)(3)(B)(i) of the Act (16 U.S.C. 1533(a)(3)(B)(i)) now provides: ''The Secretary shall not designate as critical habitat any lands or other geographic areas owned or controlled by the Department of Defense, or designated for its use, that are subject to an integrated natural resources management plan prepared under section 101 of the Sikes Act (16 U.S.C. 670a), if the Secretary determines in writing that such plan provides a benefit to the species for which critical habitat is proposed for designation.''

Within the proposed critical habitat designation area, there are no Department of Defense lands with a completed INRMP that includes the acuña cactus. The BMGR has a completed INRMP that addresses other endangered and threatened species, but it does not include management actions specific to the acuña cactus or its habitat. Therefore the BMGR lands are not exempt from the potential designation of critical habitat for acuña cactus at this time. No Department of Defense lands are being proposed for designated critical habitat for the Fickeisen plains cactus.

Exclusions

Application of Section 4(b)(2) of the Act

Section 4(b)(2) of the Act states that the Secretary shall designate and make revisions to critical habitat on the basis of the best available scientific data after taking into consideration the economic impact, national security impact, and any other relevant impact of specifying any particular area as critical habitat. The Secretary may exclude an area from critical habitat if he determines that the benefits of such exclusion outweigh the benefits of specifying such area as part of the critical habitat, unless he determines, based on the best scientific data available, that the failure to designate such area as critical habitat will result in the extinction of the species. In making that determination, the statute on its face, as well as the legislative history, are clear that the Secretary has broad discretion regarding which factor(s) to use and how much weight to give to any factor.

Under section 4(b)(2) of the Act, we may exclude an area from designated critical habitat based on economic impacts, impacts on national security, or any other relevant impacts. In considering whether to exclude a particular area from the designation, we identify the benefits of including the area in the designation, identify the benefits of excluding the area from the designation, and evaluate whether the benefits of exclusion outweigh the

benefits of inclusion. If the analysis indicates that the benefits of exclusion outweigh the benefits of inclusion, the Secretary may exercise his discretion to exclude the area only if such exclusion would not result in the extinction of the species.

Exclusions Based on Economic Impacts

Under section 4(b)(2) of the Act, we consider the economic impacts of specifying any particular area as critical habitat. In order to consider economic impacts, we are preparing an analysis of the economic impacts of the proposed critical habitat designation and related factors.

We will announce the availability of the draft economic analysis as soon as it is completed. At that time, copies of the draft economic analysis will be available for downloading from the Internet at *http://www.regulations.gov,* or by contacting the Arizona Ecological Services Field Office directly (see **FOR FURTHER INFORMATION CONTACT**). During the development of a final designation, we will consider economic impacts based on information in our economic analysis, public comments, and other new information, and areas may be excluded from the final critical habitat designation under section 4(b)(2) of the Act and our implementing regulations at 50 CFR 424.19.

Exclusions Based on National Security Impacts

Under section 4(b)(2) of the Act, we consider whether there are lands where a national security impact might exist. Department of Defense lands that are included in this proposed rule include the BMGR, as discussed above in *Application of Section 4(a)(3) of the Act*. Additionally, there are specific areas included in this proposed rule that are not owned or managed by the Department of Defense, but on which the CBP operates along the U.S.-Mexico border. CBP is tasked with maintaining national security interests along the nation's international borders. In order to achieve and maintain effective control of the United States border, CBP, through its component, the USBP, requires continuing and regular access to certain portions of the area proposed for designation as critical habitat. Because CBP's border security mission has an important link to national security, CBP may identify impacts to national security that may result from designating critical habitat. We do not have information currently indicating that lands within the proposed designation of critical habitat for the acuña cactus will have an impact on national security. However, we may consider excluding certain lands in the final rule if we receive specific, reasonable justification for that basis of a national security concern that would result from the incremental regulatory burden of critical habitat during the comment period.

We have also determined that lands within the proposed designation of critical habitat for the Fickeisen plains cactus are not owned or managed by the Department of Defense, and, therefore, we anticipate no impact on national security. Consequently, the Secretary does not propose to exert his discretion to exclude any areas from the final designation based on impacts on national security. However, should BMGR or another entity identify potential impacts to national security that may result from incremental regulatory burden of critical habitat on lands owned and managed by the BMGR, or on the lands within the critical habitat footprint for the acuña cactus we may consider excluding those lands in the final critical habitat designation under section 4(b)(2) of the Act and our implementing regulations at 50 CFR 424.19.

Exclusions Based on Other Relevant Impacts

Under section 4(b)(2) of the Act, we consider any other relevant impacts, in addition to economic impacts and impacts on national security. We consider a number of factors, including whether the landowners have developed any HCPs or other management plans for the area, or whether there are conservation partnerships that would be encouraged by designation of, or exclusion from, critical habitat. In addition, we look at any Tribal issues, and consider the government-to-government relationship of the United States with Tribal entities. We also consider any social impacts that might occur because of the designation.

The Secretary is not considering exerting his discretion to exclude any particular areas from final critical habitat for either of these species at this time under section 4(b)(2) of the Act based on partnerships, management, or protection afforded by cooperative management efforts. In this proposed rule, we are seeking input from the public as to whether or not the Secretary should exclude specific areas covered under a conservation plan, agreements based on conservation partnerships, or other such areas under management that benefit the acuña cactus and the Fickeisen plains cactus from the final revised critical habitat designation. In addition, there are Tribal lands included in the proposed designation of critical habitat for the acuña cactus and the Fickeisen plains cactus. Using the criteria found in the *Criteria Used To Identify Critical Habitat* section for both species, we have determined that tribal lands that are occupied by the acuña cactus and the Fickeisen plains cactus contain the features essential for the conservation of both species, as well as tribal lands unoccupied by the acuña cactus are essential for the conservation of the species. We will seek government-to-government consultation with these tribes throughout the public comment period and during development of the final designations of critical habitat for the acuña cactus and Fickeisen plains cactus. We will consider these areas for exclusion from the final critical habitat designation to the extent consistent with the requirements of 4(b)(2) of the Act. The Navajo Nation and the Tohono O'odham Nation are the main tribes affected by this proposed rule. (Please see the Information Requested section of this proposed revised rule for instructions on how to submit comments).

Peer Review

In accordance with our joint policy on peer review published in the **Federal Register** on July 1, 1994 (59 FR 34270), we will seek the expert opinions of at least three appropriate and independent specialists regarding this proposed rule. The purpose of peer review is to ensure that our listing determination and critical habitat designation are based on scientifically sound data, assumptions, and analyses. We have invited these peer reviewers to comment during the public comment period on our proposed listing designations of critical habitat for these two species.

We will consider all comments and information we receive during the comment period on this proposed rule during our preparation of a final determination. Accordingly, the final decision may differ from this proposal.

Public Hearings

Section 4(b)(5) of the Act provides for one or more public hearings on this proposal, if requested. Requests must be received within 45 days after the date of publication of this proposed rule in the **Federal Register**. Such requests must be sent to the address shown in the **FOR FURTHER INFORMATION CONTACT** section. We will schedule public hearings on this proposal, if any are requested, and announce the dates, times, and places of those hearings, as well as how to obtain reasonable accommodations, in the **Federal Register** and local newspapers at least 15 days before the hearing.

Required Determinations

Regulatory Planning and Review—Executive Orders 12866 and 13563

Executive Order 12866 provides that the Office of Information and Regulatory Affairs (OIRA) will review all significant rules. The Office of Information and Regulatory Affairs has determined that this rule is not significant.

Executive Order 13563 reaffirms the principles of E.O. 12866 while calling for improvements in the nation's regulatory system to promote predictability, to reduce uncertainty, and to use the best, most innovative, and least burdensome tools for achieving regulatory ends. The executive order directs agencies to consider regulatory approaches that reduce burdens and maintain flexibility and freedom of choice for the public where these approaches are relevant, feasible, and consistent with regulatory objectives. E.O. 13563 emphasizes further that regulations must be based on the best available science and that the rulemaking process must allow for public participation and an open exchange of ideas. We have developed this rule in a manner consistent with these requirements.

Regulatory Flexibility Act (5 U.S.C. 601 et seq.)

Under the Regulatory Flexibility Act (RFA; 5 U.S.C. 601 *et seq.*) as amended by the Small Business Regulatory Enforcement Fairness Act (SBREFA) of 1996 (5 U.S.C 801 *et seq.*), whenever an agency must publish a notice of rulemaking for any proposed or final rule, it must prepare and make available for public comment a regulatory flexibility analysis that describes the effects of the rule on small entities (small businesses, small organizations, and small government jurisdictions). However, no regulatory flexibility analysis is required if the head of the agency certifies the rule will not have a significant economic impact on a substantial number of small entities. The SBREFA amended the RFA to require Federal agencies to provide a certification statement of the factual basis for certifying that the rule will not have a significant economic impact on a substantial number of small entities.

At this time, we lack the available economic information necessary to provide an adequate factual basis for the required RFA finding. Therefore, we defer the RFA finding until completion of the draft economic analysis prepared under section 4(b)(2) of the Act and Executive Order 12866. This draft economic analysis will provide the required factual basis for the RFA finding. Upon completion of the draft economic analysis, we will announce availability of the draft economic analysis of the proposed designation in the **Federal Register** and reopen the public comment period for the proposed designation. We will include with this announcement, as appropriate, an initial regulatory flexibility analysis or a certification that the rule will not have a significant economic impact on a substantial number of small entities accompanied by the factual basis for that determination. The proposed critical habitat areas include Federal, State, military, Tribal, and private lands, some of which are used for mining and recreation (such as hiking, camping, horseback riding, and hunting). We have concluded that deferring the RFA finding until completion of the draft economic analysis is necessary to meet the purposes and requirements of the RFA. Deferring the RFA finding in this manner will ensure that we make a sufficiently informed determination based on adequate economic information and provide the necessary opportunity for public comment.

Energy Supply, Distribution, or Use—Executive Order 13211

Executive Order 13211 (Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use) requires agencies to prepare Statements of Energy Effects when undertaking certain actions. Because there are no energy facilities within the footprint of the proposed critical habitat boundaries, and we are unaware of energy projects currently proposed within the boundaries, we do not expect the designation of this proposed critical habitat to significantly affect energy supplies, distribution, or use. Therefore, this action is not a significant energy action, and no Statement of Energy Effects is required. However, we will further evaluate this issue as we conduct our economic analysis, and review and revise this assessment as warranted.

Unfunded Mandates Reform Act (2 U.S.C. 1501 et seq.)

In accordance with the Unfunded Mandates Reform Act (2 U.S.C. 1501 *et seq.*), we make the following findings:

(1) This rule would not produce a Federal mandate. In general, a Federal mandate is a provision in legislation, statute, or regulation that would impose an enforceable duty upon State, local, or Tribal governments, or the private sector, and includes both ''Federal intergovernmental mandates'' and ''Federal private sector mandates.'' These terms are defined in 2 U.S.C. 658(5)–(7). ''Federal intergovernmental mandate'' includes a regulation that ''would impose an enforceable duty upon State, local, or tribal governments'' with two exceptions. It excludes ''a condition of Federal assistance.'' It also excludes ''a duty arising from participation in a voluntary Federal program,'' unless the regulation ''relates to a then-existing Federal program under which $500,000,000 or more is provided annually to State, local, and Tribal governments under entitlement authority,'' if the provision would ''increase the stringency of conditions of assistance'' or ''place caps upon, or otherwise decrease, the Federal Government's responsibility to provide funding,'' and the State, local, or Tribal governments ''lack authority'' to adjust accordingly. At the time of enactment, these entitlement programs were: Medicaid; Aid to Families with Dependent Children work programs; Child Nutrition; Food Stamps; Social Services Block Grants; Vocational Rehabilitation State Grants; Foster Care, Adoption Assistance, and Independent Living; Family Support Welfare Services; and Child Support Enforcement. ''Federal private sector mandate'' includes a regulation that ''would impose an enforceable duty upon the private sector, except (i) a condition of Federal assistance or (ii) a duty arising from participation in a voluntary Federal program.''

The designation of critical habitat does not impose a legally binding duty on non-Federal Government entities or private parties. Under the Act, the only regulatory effect is that Federal agencies must ensure that their actions do not destroy or adversely modify critical habitat under section 7. While non-Federal entities that receive Federal funding, assistance, or permits, or that otherwise require approval or authorization from a Federal agency for an action, may be indirectly impacted by the designation of critical habitat, the legally binding duty to avoid destruction or adverse modification of critical habitat rests squarely on the Federal agency. Furthermore, to the extent that non-Federal entities are indirectly impacted because they receive Federal assistance or participate in a voluntary Federal aid program, the Unfunded Mandates Reform Act would not apply, nor would critical habitat shift the costs of the large entitlement programs listed above onto State governments.

(2) We do not believe that this rule would significantly or uniquely affect small governments. The lands being proposed for critical habitat designation are predominantly owned by the Bureau

of Land Management, the Bureau of Reclamation, the U.S. Military, the U.S. Forest Service, the National Park Service, the State of Arizona, and the Tohono O'odham and Navajo Nations. None of these government entities fit the definition of ''small governmental jurisdiction.'' Therefore, a Small Government Agency Plan is not required. However, we will further evaluate this issue as we conduct our economic analysis, and review and revise this assessment if appropriate.

Takings—Executive Order 12630

In accordance with Executive Order 12630 (Government Actions and Interference with Constitutionally Protected Private Property Rights), we have analyzed the potential takings implications of designating critical habitat for the acuña cactus and the Fickeisen plains cactus in a takings implications assessment. Critical habitat designation does not affect landowner actions that do not require Federal funding or permits, nor does it preclude development of habitat conservation programs or issuance of incidental take permits to permit actions that do require Federal funding or permits to go forward. The takings implications assessment concludes that this designation of critical habitat for the acuña cactus and the Fickeisen plains cactus does not pose significant takings implications for lands within or affected by the designation. However, we have not yet completed the economic analysis for this proposed rule. Once the economic analysis is available, we will review and revise this preliminary assessment as warranted, and prepare a takings implication assessment.

Federalism—Executive Order 13132

In accordance with Executive Order 13132 (Federalism), this proposed rule does not have significant Federalism effects. A Federalism summary impact statement is not required. In keeping with Department of the Interior and Department of Commerce policy, we requested information from, and coordinated development of, this proposed critical habitat designation with appropriate State resource agencies in Arizona. The designation of critical habitat in areas currently occupied by the acuña cactus or the Fickeisen plains cactus may impose nominal additional regulatory restrictions to those currently in place and, therefore, may have little incremental impact on State and local governments and their activities. The designation may have some benefit to these governments because the areas that contain the physical or biological features essential to the conservation of the species are more clearly defined, and the elements of the features of the habitat necessary to the conservation of the species are specifically identified. This information does not alter where and what federally sponsored activities may occur. However, it may assist local governments in long-range planning (rather than having them wait for case-by-case section 7 consultations to occur).

Where State and local governments require approval or authorization from a Federal agency for actions that may affect critical habitat, consultation under section 7(a)(2) would be required. While non-Federal entities that receive Federal funding, assistance, or permits, or that otherwise require approval or authorization from a Federal agency for an action, may be indirectly impacted by the designation of critical habitat, the legally binding duty to avoid destruction or adverse modification of critical habitat rests squarely on the Federal agency.

Civil Justice Reform—Executive Order 12988

In accordance with Executive Order 12988 (Civil Justice Reform), the Office of the Solicitor has determined that the rule does not unduly burden the judicial system and that it meets the requirements of sections 3(a) and 3(b)(2) of the Order. We have proposed designating critical habitat in accordance with the provisions of the Act. This proposed rule uses standard property descriptions and identifies the elements of physical or biological features essential to the conservation of the acuña cactus and the Fickeisen plains cactus within the designated areas to assist the public in understanding the habitat needs of the species.

Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.)

This rule does not contain any new collections of information that require approval by OMB under the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 *et seq.*). This rule will not impose recordkeeping or reporting requirements on State or local governments, individuals, businesses, or organizations. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number.

National Environmental Policy Act (42 U.S.C. 4321 et seq.)

We have determined that environmental assessments and environmental impact statements, as defined under the authority of NEPA (42 U.S.C. 4321 *et seq.*), need not be prepared in connection with listing a species as an endangered or a threatened species under the Act. We published a notice outlining our reasons for this determination in the **Federal Register** on October 25, 1983 (48 FR 49244).

It is our position that, outside the jurisdiction of the U.S. Court of Appeals for the Tenth Circuit, we do not need to prepare environmental analyses pursuant to NEPA in connection with designating critical habitat under the Act. We published a notice outlining our reasons for this determination in the **Federal Register** on October 25, 1983 (48 FR 49244). This position was upheld by the U.S. Court of Appeals for the Ninth Circuit (*Douglas County* v. *Babbitt,* 48 F.3d 1495 (9th Cir. 1995), cert. denied 516 U.S. 1042 (1996)).

Clarity of the Rule

We are required by Executive Orders 12866 and 12988 and by the Presidential Memorandum of June 1, 1998, to write all rules in plain language. This means that each rule we publish must:

(1) Be logically organized;

(2) Use the active voice to address readers directly;

(3) Use clear language rather than jargon;

(4) Be divided into short sections and sentences; and

(5) Use lists and tables wherever possible.

If you feel that we have not met these requirements, send us comments by one of the methods listed in the **ADDRESSES** section. To better help us revise the rule, your comments should be as specific as possible. For example, you should tell us the numbers of the sections or paragraphs that are unclearly written, which sections or sentences are too long, the sections where you feel lists or tables would be useful, etc.

Government-to-Government Relationship With Tribes

In accordance with the President's memorandum of April 29, 1994 (Government-to-Government Relations with Native American Tribal Governments; 59 FR 22951), Executive Order 13175 (Consultation and Coordination With Indian Tribal Governments), and the Department of the Interior's manual at 512 DM 2, we readily acknowledge our responsibility to communicate meaningfully with recognized Federal Tribes on a government-to-government basis. In accordance with Secretarial Order 3206 of June 5, 1997 (American Indian Tribal

Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act), we readily acknowledge our responsibilities to work directly with tribes in developing programs for healthy ecosystems, to acknowledge that Tribal lands are not subject to the same controls as Federal public lands, to remain sensitive to Indian culture, and to make information available to tribes.

There are Tribal lands included in the proposed designation of critical habitat for the acuña cactus and the Fickeisen plains cactus. Using the criteria found in the *Criteria Used To Identify Critical Habitat* section for both species, we have determined that tribal lands that are occupied by the acuña cactus and the Fickeisen plains cactus contain the features essential for the conservation of both species, as well as tribal lands unoccupied by the acuña cactus are essential for the conservation of the species. We will seek government-to-government consultation with these tribes throughout the public comment period and during development of the final designations of critical habitat for the acuña cactus and Fickeisen plains cactus. We will consider these areas for exclusion from the final critical habitat designation to the extent consistent with the requirements of 4(b)(2) of the Act. The Navajo Nation and the Tohono O'odham Nation are the main tribes affected by this proposed rule. We recently sent a notification letter to the Navajo Nation and the Tohono O'odham Nation describing the exclusion process under section 4(b)(2) of the Act, and we have engaged in conversations with the Tribes about the proposal to the extent possible without disclosing pre-decisional information. In addition, we have engaged in informal conservations with representatives of the Navajo Nation and the Tohono O'odham Nation during the listing process and so the tribes has been made aware that the Service is working on critical habitat proposals for the two species. We will schedule a meeting with the Navajo Nation and Tohono O'odham Nation and any other interested tribes shortly after publication of this proposed rule so that we can give them as much time as possible to comment. We will also send letters to all other tribes with interest in the general geographical areas of the acuña cactus and Fickeisen plains cactus range, including the following: Ak Chin Indian Community; Chemehuevi Indian Tribe; Cocopah Tribe; Colorado River Indian Tribes; Havasupai Tribe; Hopi Tribe; Kaibab Band of Paiute Indians; Pascua Yaqui Tribe; Salt River Pima-Maricopa Indian Community; San Carlos Apache Tribe; White Mountain Apache Tribe; Yavapai-Apache Nation; Yavapai-Prescott Tribe; and Pueblo of Zuni Tribe.

References Cited

A complete list of references cited in this proposed rulemaking is available on the Internet at *http://www.regulations.gov* and upon request from the Arizona Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**).

Authors

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

List of Subjects in 50 CFR Part 17

Endangered and threatened species, Exports, Imports, Reporting and recordkeeping requirements, Transportation.

Proposed Regulation Promulgation

Accordingly, we propose to amend part 17, subchapter B of chapter I, title 50 of the Code of Federal Regulations, as set forth below:

PART 17—[AMENDED]

1. The authority citation for part 17 continues to read as follows:

Authority: 16 U.S.C. 1361–1407; 16 U.S.C. 1531–1544; 16 U.S.C. 4201–4245; Pub. L. 99–625, 100 Stat. 3500; unless otherwise noted.

2. Amend § 17.12(h) by adding entries for ''*Echinomastus erectocentrus* var. *acunensis*'' and ''*Pediocactus peeblesianus* var. *fickeiseniae*'' in alphabetical order under FLOWERING PLANTS, to the List of Endangered and Threatened Plants, as follows:.

§ 17.12 Endangered and threatened plants.

* * * * *

(h) * * *

Species		Historic range	Family	Status	When listed	Critical habitat	Special rules
Scientific name	Common name						
FLOWERING PLANTS							
*	*	*	*	*	*		*
Echinomastus erectocentrus var. *acunensis*.	Acuña cactus	U.S.A. (AZ), Mexico	Cactaceae	E		17.96(a)	NA
*	*	*	*	*	*		*
Pediocactus peeblesianus var. *fickeiseniae*.	Fickeisen plains cactus.	U.S.A. (AZ)	Cactaceae	E		17.96(a)	NA
*	*	*	*	*	*		*

3. Amend § 17.96 by adding entries for ''*Echinomastus erectocentrus* var. *acunensis* (acuña cactus) and ''*Pediocactus peeblesianus* var. *fickeiseniae* (Fickeisen plains cactus),'' in alphabetical order under the family Cactaceae, to read as follows.

§ 17.96 Critical habitat—plants.

(a) *Flowering plants.*

* * * * *

Family Cactaceae: *Echinomastus erectocentrus* var. *acunensis* (acuña cactus)

(1) Critical habitat units are depicted for Maricopa, Pima, and Pinal Counties, Arizona, on the maps below.

(2) Within these areas, the primary constituent elements of the physical or biological features essential to the conservation of the acuña cactus consist of:

(i) Native vegetation within the Paloverde-Cacti-Mixed Scrub Series of the Arizona Upland Subdivision of the Sonoran Desert-scrub at elevations between 365 to 1,150 m (1,198 to 3,773 ft). This vegetation must contain predominantly native plant species that:

a. Provide protection to the acuña cactus. Examples of such plants are creosote bush, ironwood, and palo verde;

b. Provide for pollinator habitat with a radius of 900 m (2,953 ft) around each individual, reproducing acuña cactus;

c. Allow for seed dispersal through the presence of bare soils immediately adjacent to and within 10 m (32.8 ft) of individual, reproducing acuña cactus.

(ii) Soils overlying rhyolite, andesite, tuff, granite, granodiorite, diorite, or Cornelia quartz monzonite bedrock that are in valley bottoms, on small knolls, or on ridgetops, and are generally on slopes of less than 30 percent.

(3) Critical habitat does not include manmade structures (such as buildings, aqueducts, runways, roads, and other paved areas) and the land on which they are located existing within the legal boundaries on the effective date of this rule.

(4) *Critical habitat map units.* Digital data layers defining map units were created using geology, topography, elevation, vegetation community, mean annual precipitation from the 1971 to 2000 period of record, and acuña cactus herbarium and site visit records from 1952 to the present; these were mapped using Universal Transverse Mercator (UTM) coordinates. The maps in this entry, as modified by any accompanying regulatory text, establish the boundaries of the critical habitat designation. The coordinates or plot points or both on which each map is based are available to the public at the Service's internet site, (*http://www.fws.gov/southwest/es/arizona/*), (*http://www.regulations.gov* at Docket No. FWS–RX–ES–2012–0061 and at the field office responsible for this designation. You may obtain field office location information by contacting one of the Service regional offices, the addresses of which are listed at 50 CFR 2.2.

(5) Index map follows:

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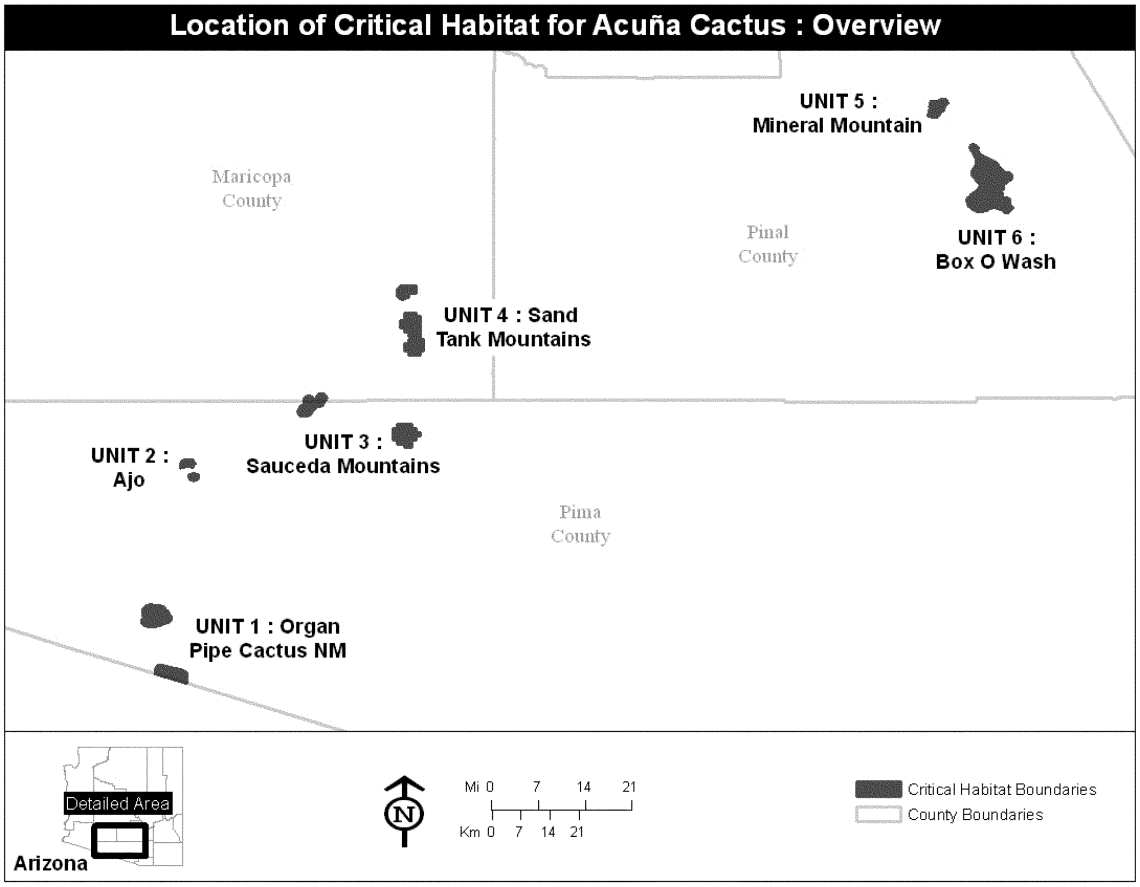
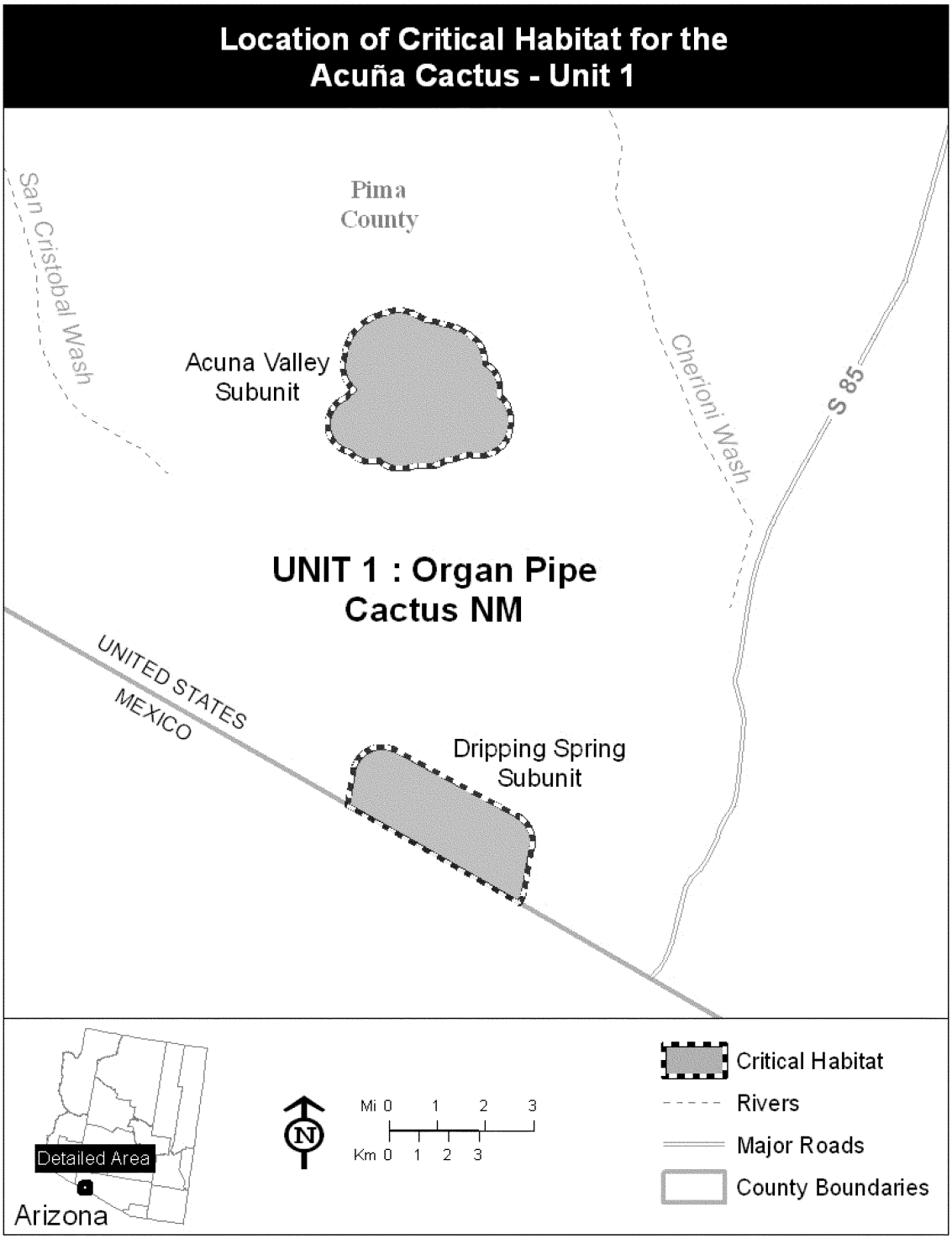
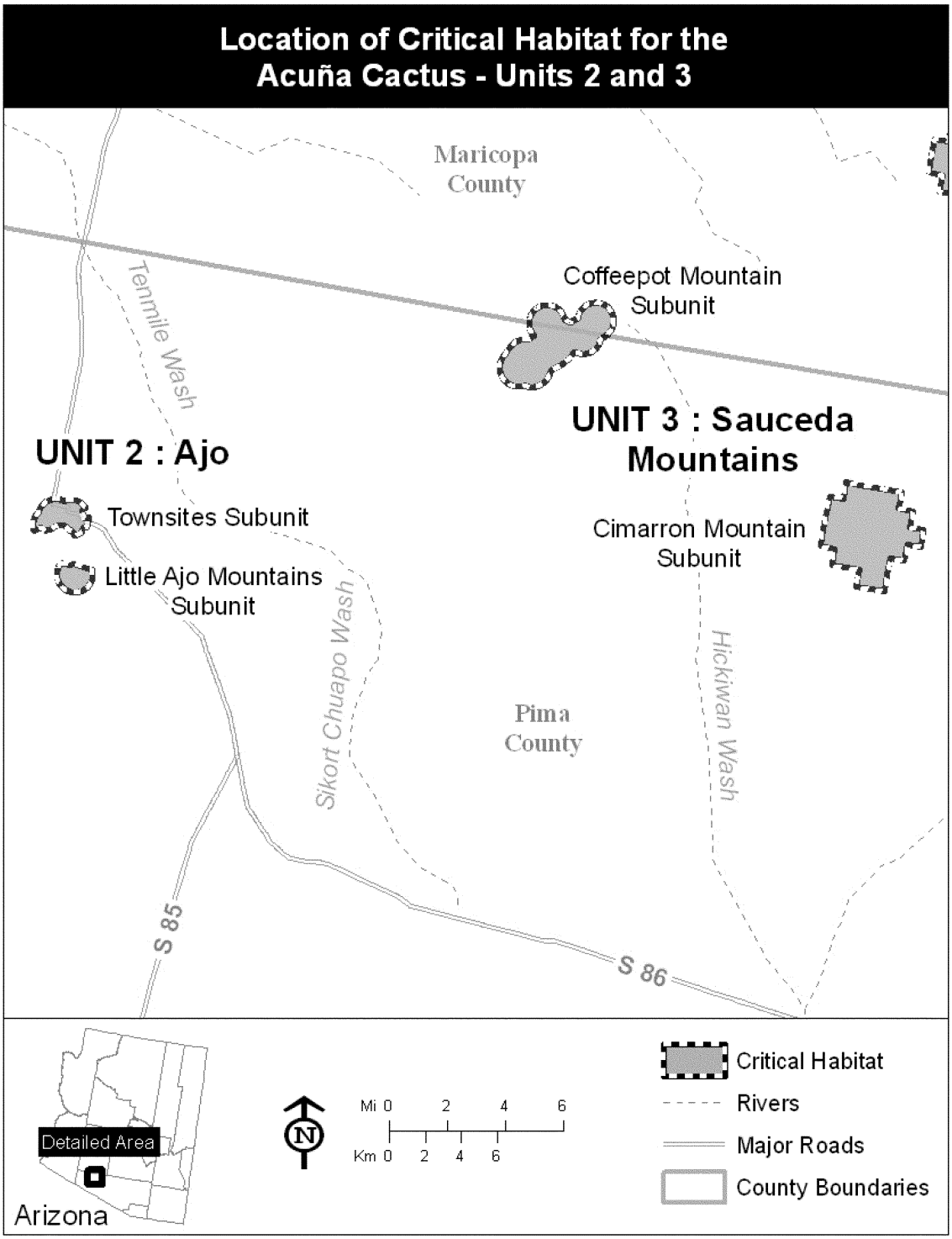


(6) Unit 1: Organ Pipe Cactus National Monument, Pima County, AZ. Map of Unit 1 follows:

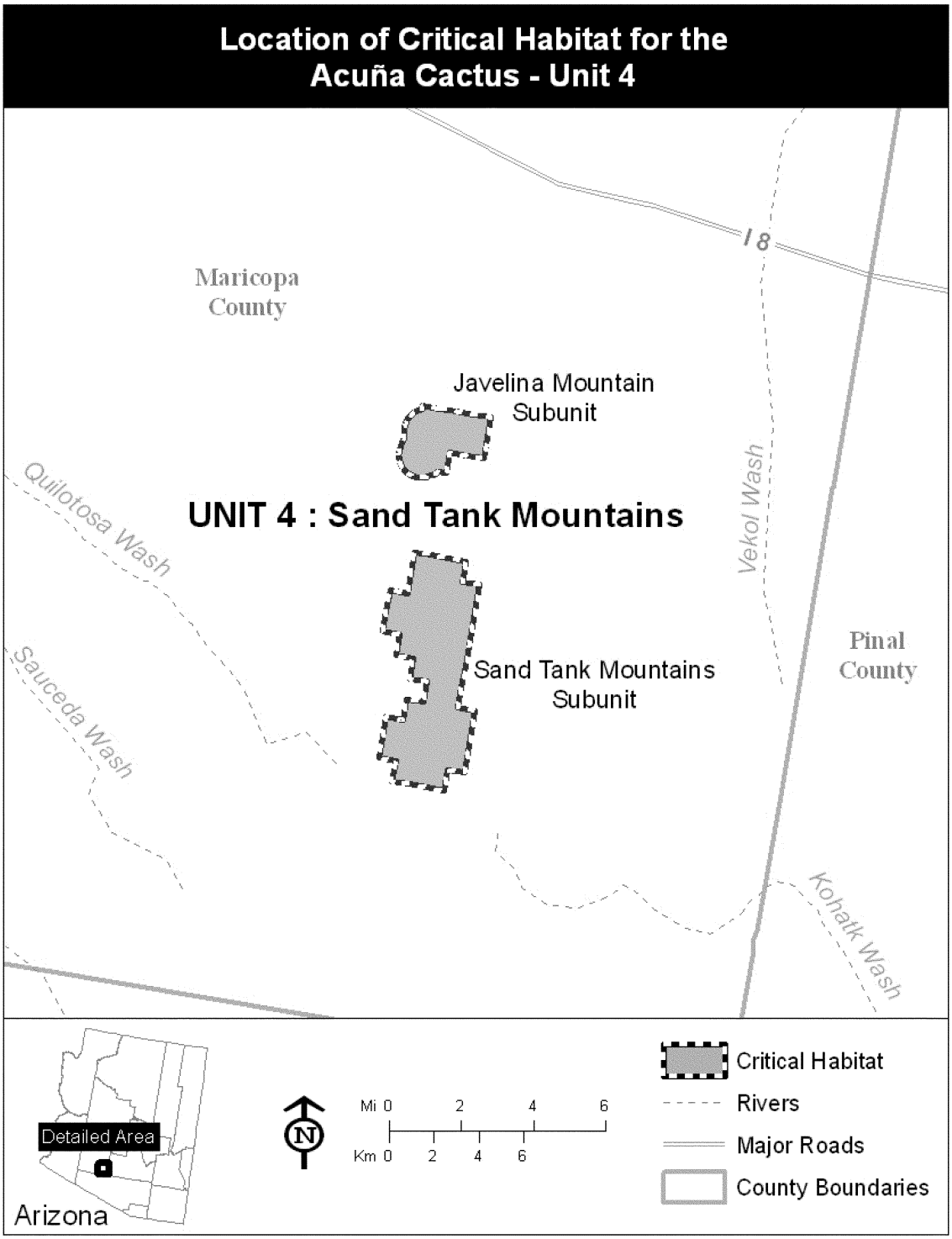


(7) Unit 2: Ajo Unit, Pima County, AZ.
Map of Unit 2 follows:

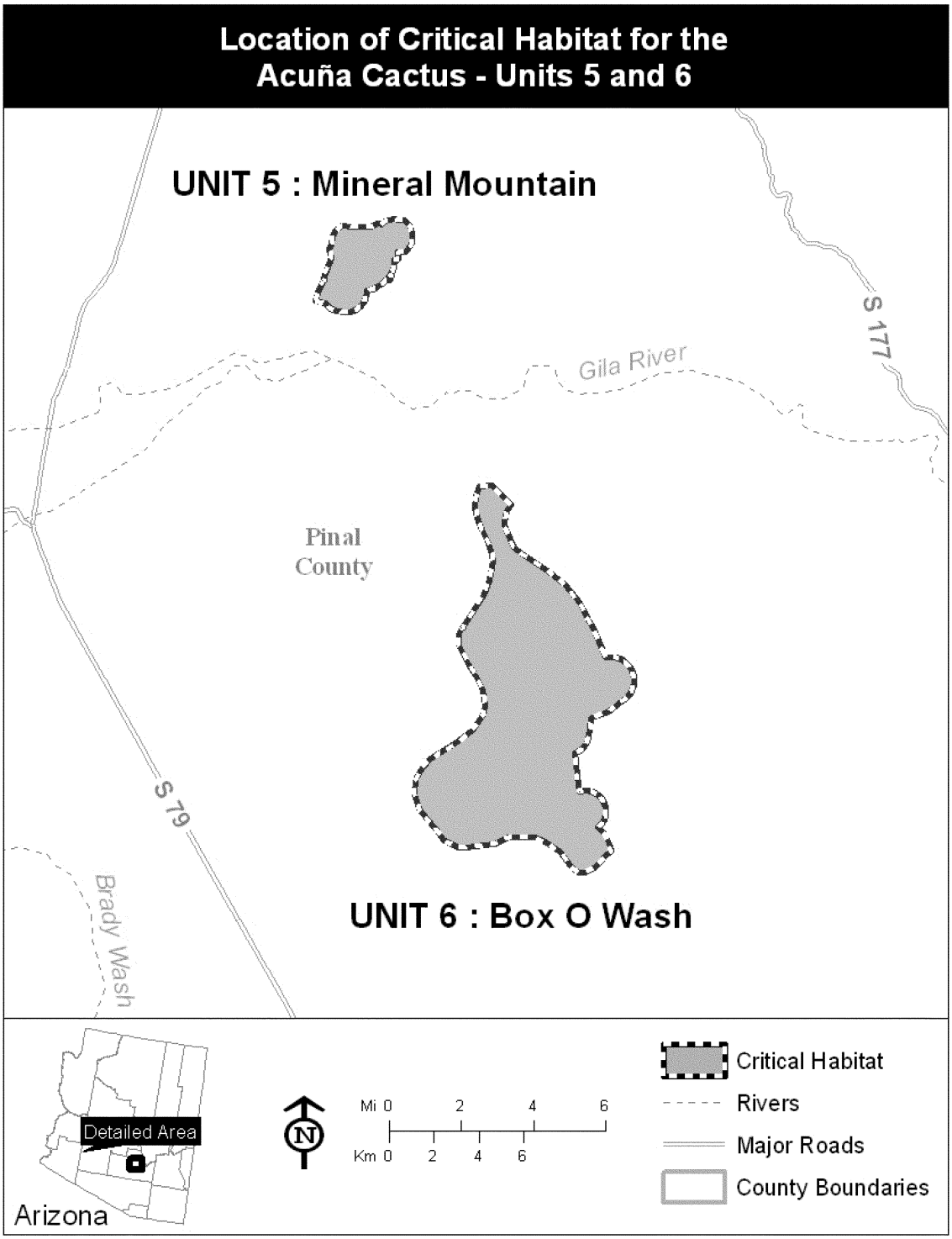


(8) Unit 3: Sauceda Mountains Unit, Maricopa and Pima Counties, AZ. Map of Unit 3 is provided at paragraph (7) of this entry.

(9) Unit 4: Sand Tank Mountains Unit, Maricopa County, AZ. Map of Unit 4 follows:



(10) Unit 5: Mineral Mountain Unit and Unit, Pinal County, AZ. Map of Units 5 and 6 follows:



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(11) Unit 6: Box O Wash Unit, Pinal County, AZ. Map of Unit 6 is provided at paragraph (10) of this entry.

Family Cactaceae: *Pediocactus peeblesianus* var. *fickeiseniae* (Fickeisen plains cactus)

(1) Critical habitat units are depicted for Mohave and Coconino Counties, Arizona, on the maps below.

(2) Within these areas, the primary constituent elements of the physical or biological features essential to the conservation of the Fickeisen plains cactus consist of:

(i) Soils in northern Arizona on the Colorado Plateau that are:

a. Formed from alluvium, colluvium, or Aeolian deposits;

b. Derived from limestone of the Harrisburg member of the Kaibab Formation and Toroweap Formation;

c. Underlain with Coconino Sandstone, and sandstone and mudstone of the Moenkopi Formation;

d. At an elevation of 1,310 to 1,813 m (4,200 to 5,950 ft);

e. Are gravelly-loam, fine-textured, well drained, and shallow;

f. On terraces, benches, tops of mesas and plateaus, toe-slope of hills with a 0 to 20 percent slope;

g. Supportive of biological soil crusts;

h. Within the Plains and Great Basin grassland and Great Basin desert scrub vegetation communities;

(ii) Native vegetation in areas that have natural, generally intact surface and subsurface features that provide habitat and suitable nesting substrate for the cactus' pollinators and space for seed dispersal and germination; and

(iii) Provide for pollinator habitat with a radius of 1,000 m (3,280 ft) around each individual, reproducing Fickeisen plains cactus.

(3) Critical habitat does not include manmade structures (such as buildings, aqueducts, runways, roads, and other paved areas) and the land on which they are located existing within the legal boundaries on the effective date of this rule.

(4) *Critical habitat map units.* Data layers defining map units were created using a base of U.S. Geological Survey 7.5' quadrangle maps. Critical habitat units were then mapped using Universal Transverse Mercator (UTM) zone 11, North American Datum (NAD) 1983 coordinates.

(5) **Note:** Index map follows:

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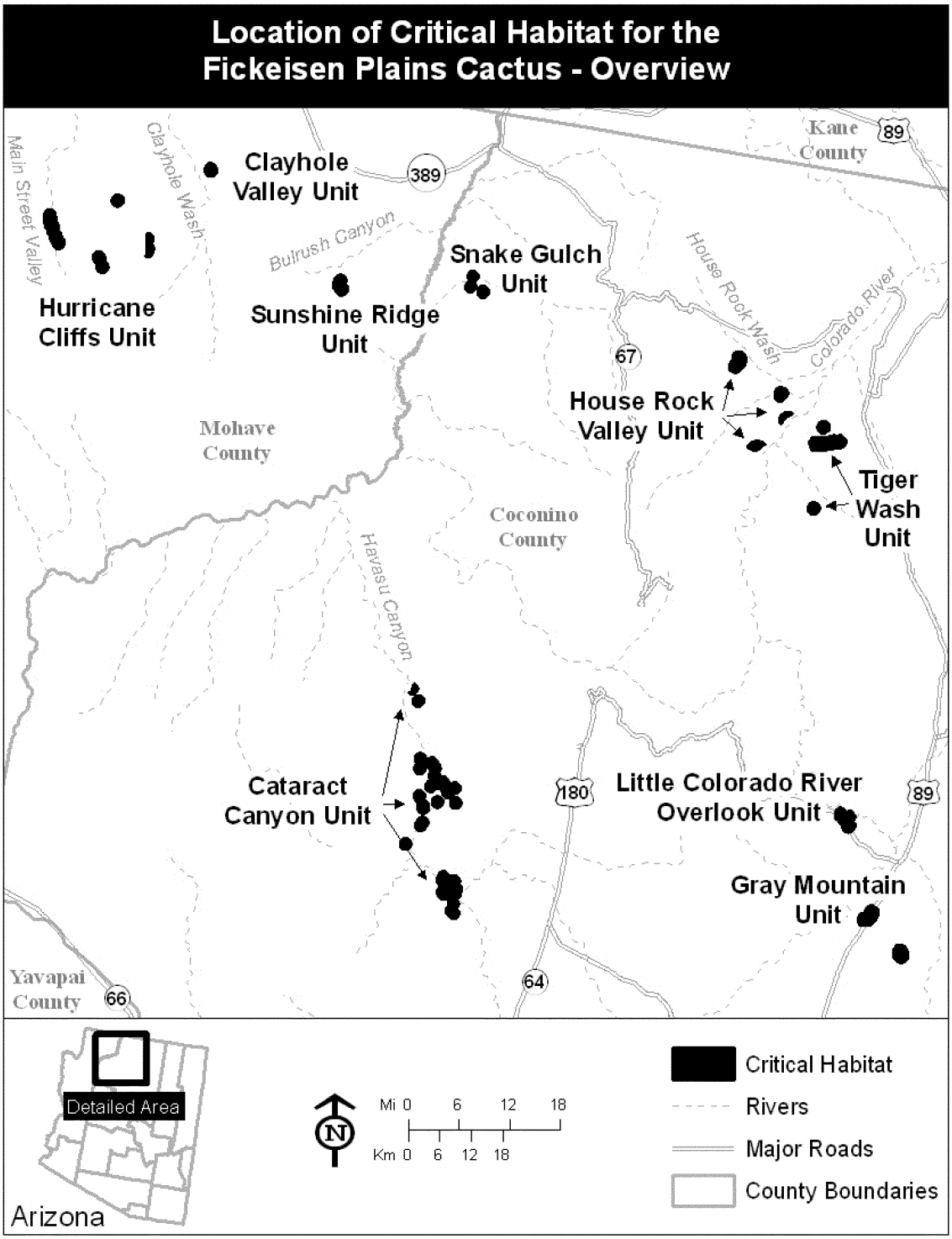
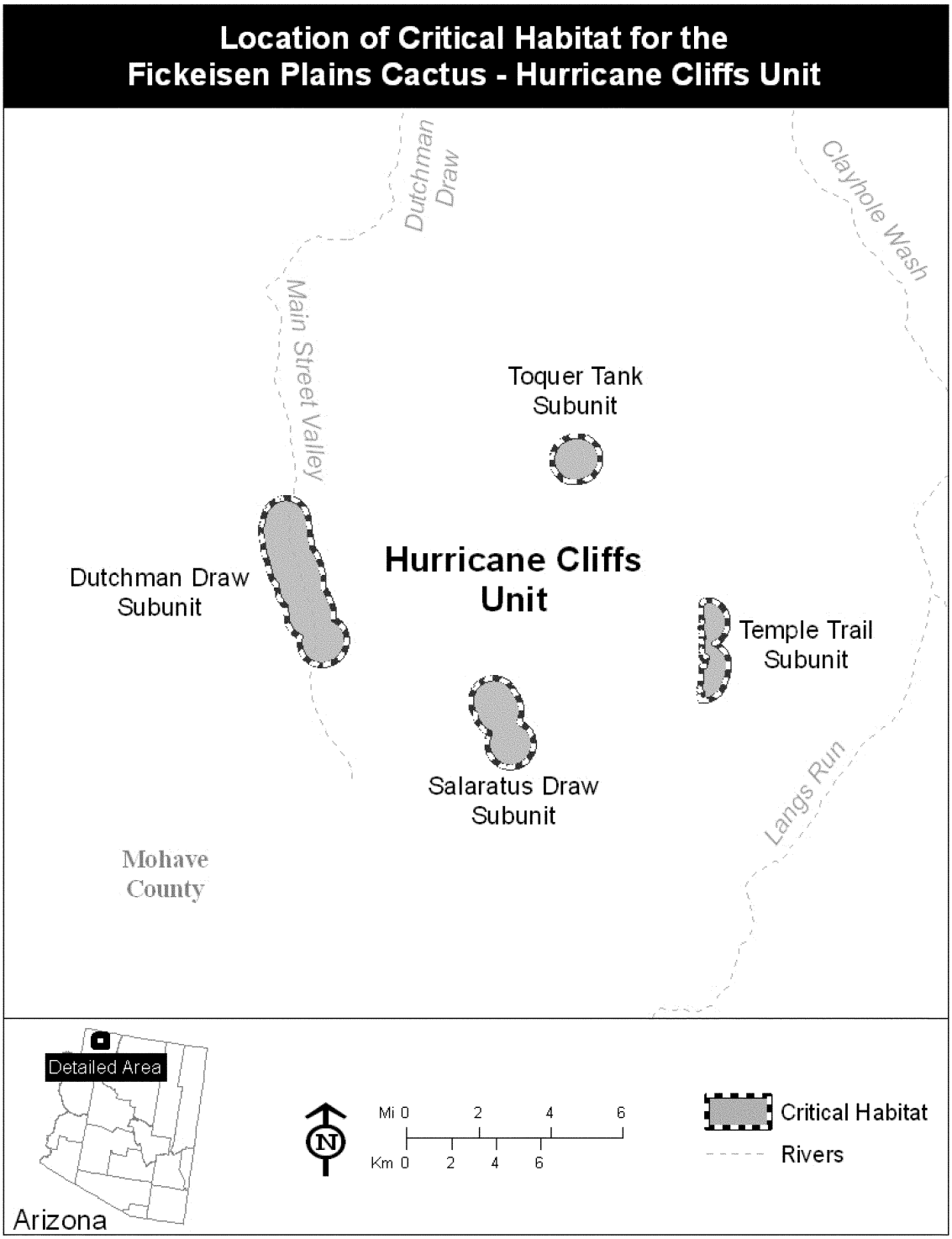
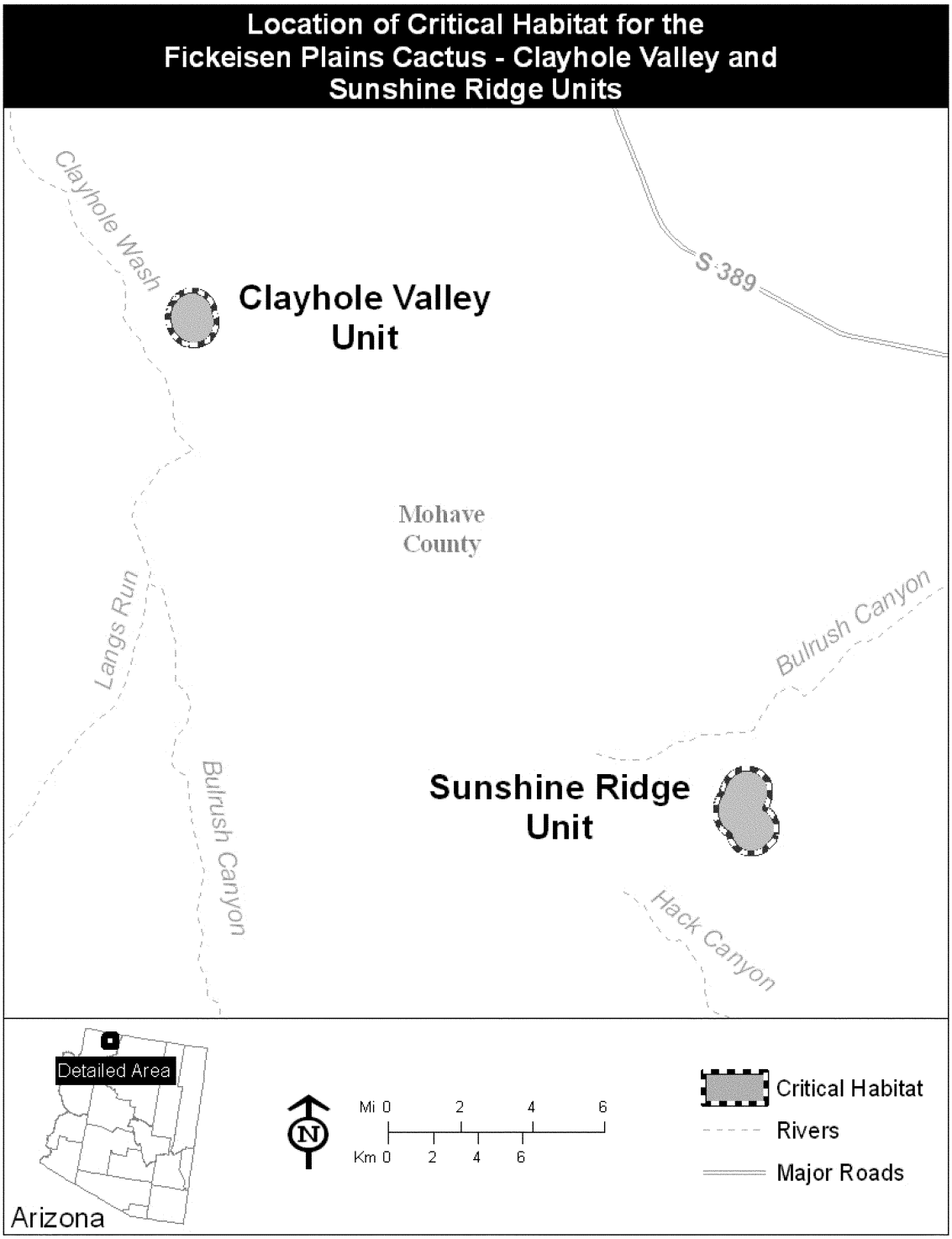


(6) Unit 1: Hurricane Cliffs Unit, Mohave County, AZ. Map of Unit 1 follows:

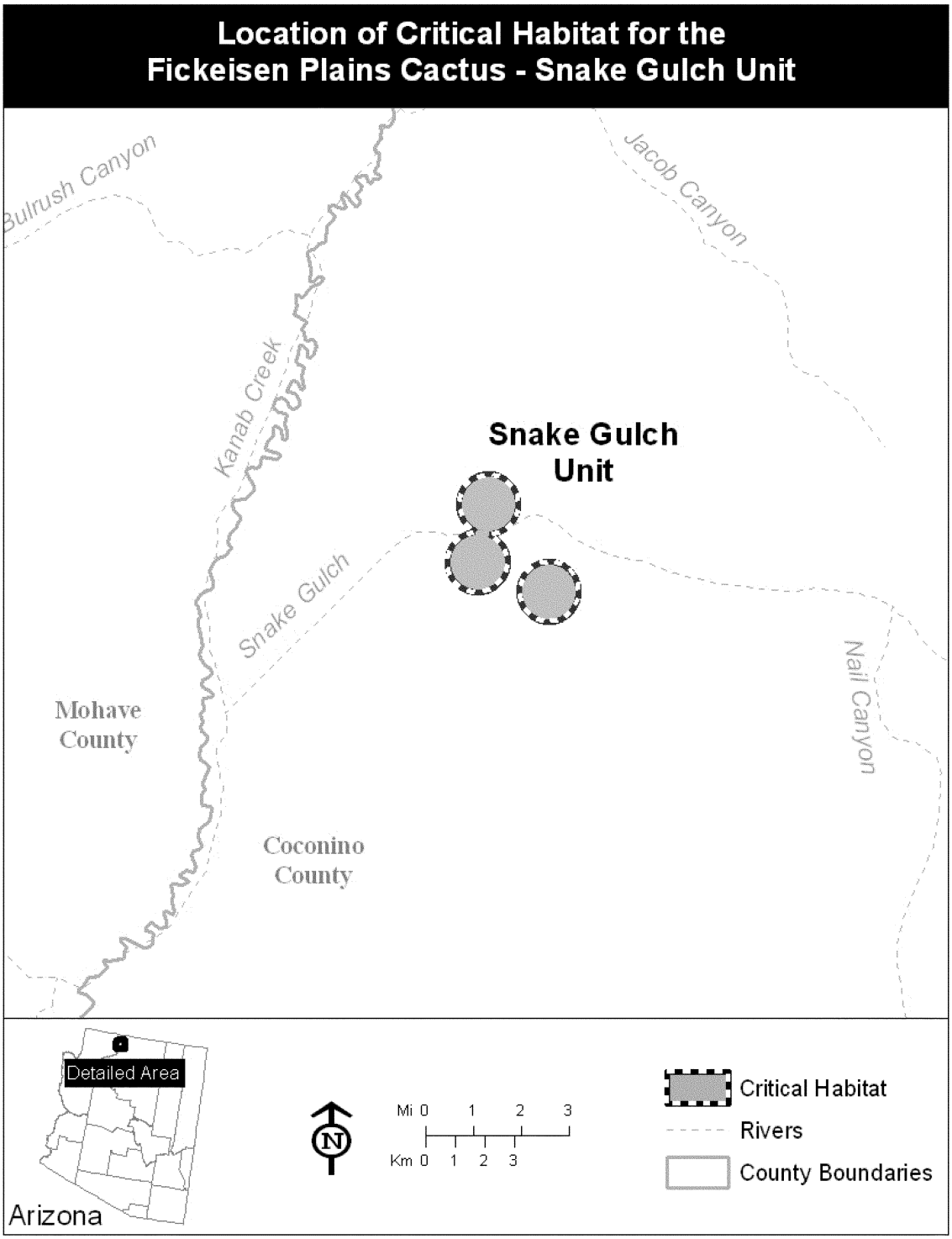


(7) Unit 2: Sunshine Ridge Unit, Mohave County, AZ. Map of Units 2 and 3 follow:

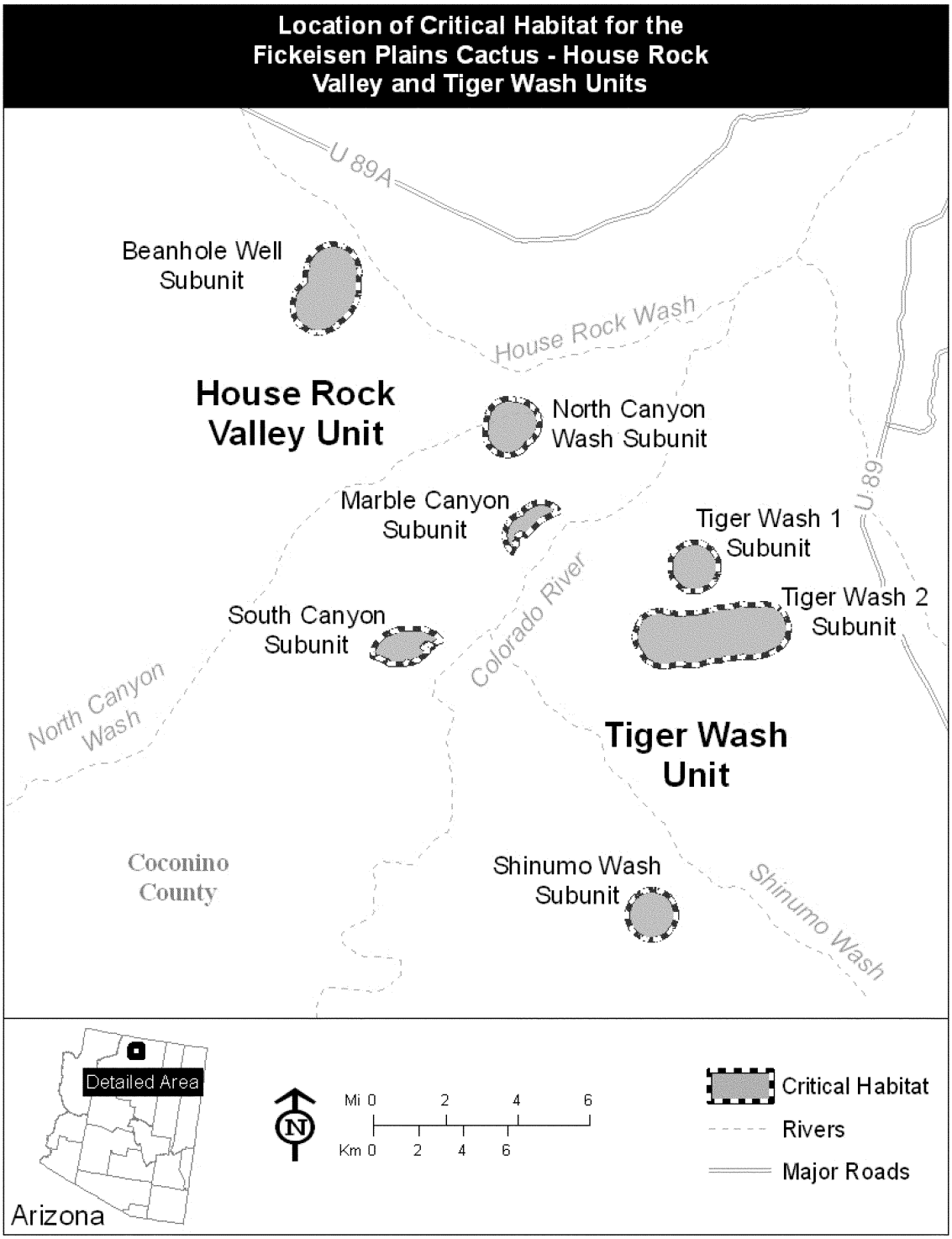


(8) Unit 3: Clayhole Valley Unit, Mohave County, AZ. Map of Unit 3 is provided at paragraph (7) of this entry.

(9) Unit 4: Snake Gulch Unit, Coconino County, AZ. Map of Unit 4 follows:

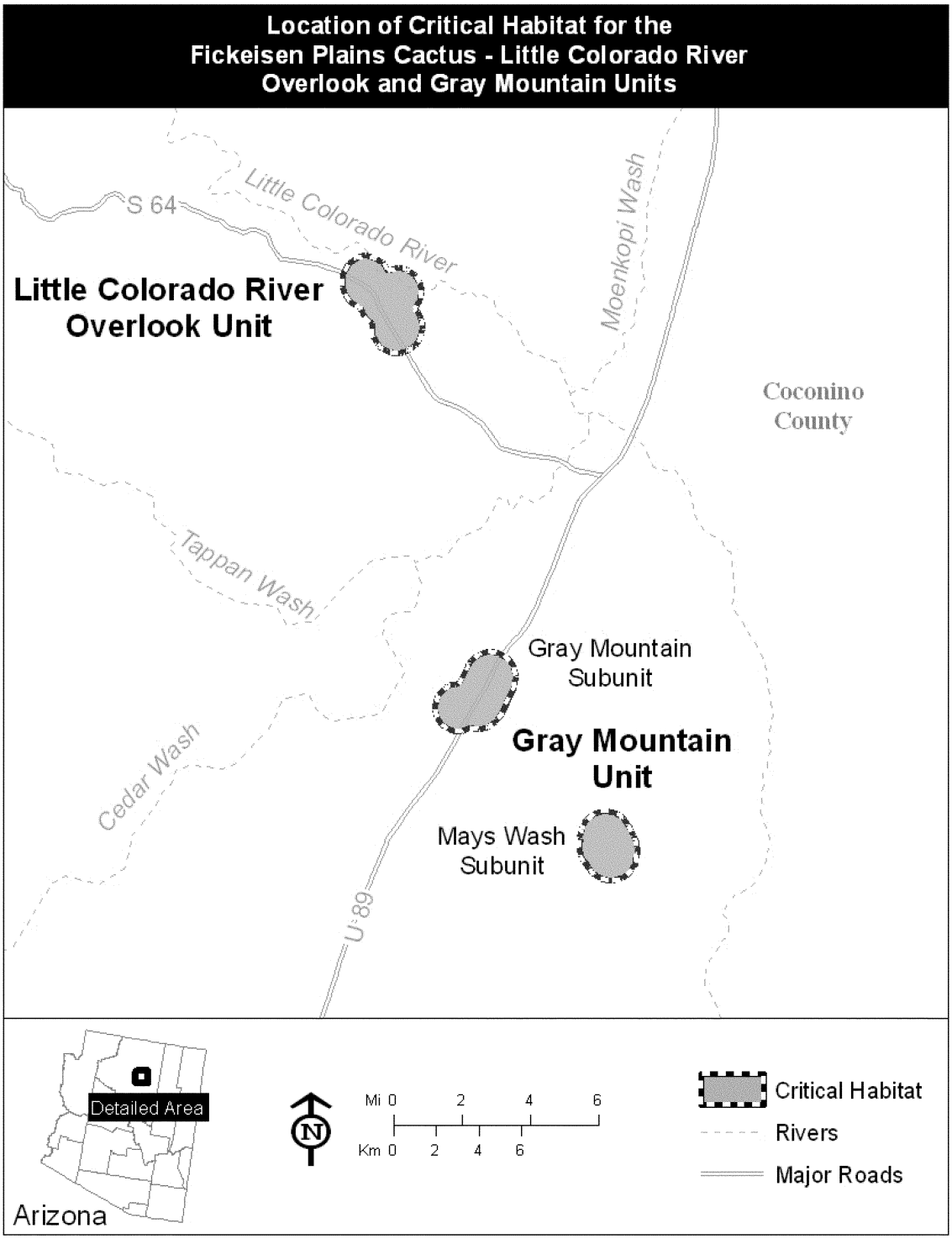


(10) Unit 5: House Rock Valley Unit, Coconino County, AZ. Maps of Unit 5 and 6 follows:



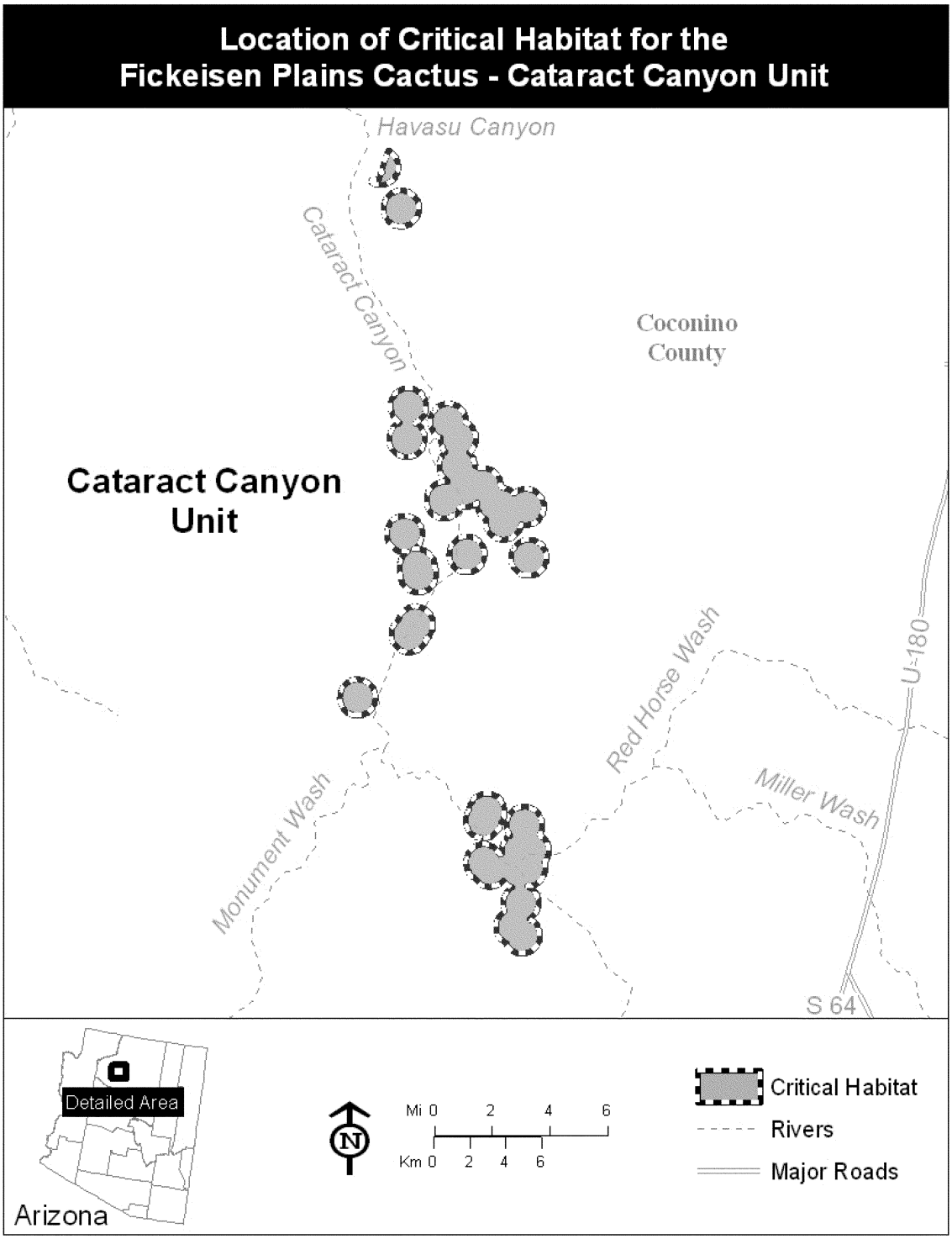
(11) Unit 6: Tiger Wash Unit, Coconino County, AZ. Map of Unit 6 is provided at paragraph (10) of this entry.

(12) Unit 7: Little Colorado River Overlook Unit, Coconino County, AZ. Map of Units 7 and 8 follows:



(13) Unit 8: Gray Mountain Unit, Coconino County, AZ. Map of Unit 8 is provided at paragraph (12) of this entry.

(14) Unit 9: Cataract Canyon Unit, Coconino County, AZ. Map of Unit 9 follows:



* * * * *

Dated: September 17, 2012.

Michael J. Bean,

Acting Principal Deputy Assistant Secretary for Fish and Wildlife and Parks.

[FR Doc. 2012–23853 Filed 10–2–12; 8:45 am]

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