CANDIDATE CONSERVATION AGREEMENT

for the

Paradine (Kaibab) Plains Cactus (*Pediocactus paradinei*)

AMONG

U.S. Fish and Wildlife Service
U.S. Forest Service, Kaibab National Forest
Bureau of Land Management, Arizona Strip District

Photo : K. Miles 2009

Amended and Revised: September 2015

1. SUMMARY (ABSTRACT)

The Paradine plains cactus (*Pediocactus paradinei* B. W. Benson) is known exclusively from the eastern slopes of the Kaibab Plateau (East Kaibab monocline) and small portions of adjoining House Rock and Coyote valleys. Another common name for the species is Kaibab plains cactus. This amended and revised Candidate Conservation Agreement (CCA) for the Paradine plains cactus has been developed as a cooperative effort among the federal agencies in order to collectively implement proactive conservation measures and habitat management guidelines throughout the entire range of the species. Furthermore, this CCA updates, supersedes, and improves upon the CCA for the Paradine plains cactus finalized in 1997 and is based upon current habitat threats, implemented management actions, and information derived from data collected since the Paradine Plains Cactus Conservation Assessment and Strategy was completed in 1996.

Implementation of this CCA addresses conservation needs of the Paradine plains cactus and will allow the parties to this CCA (Cooperators) to leverage knowledge and funding within a common conservation framework to reduce threats to and benefit the Paradine plains cactus. The effect of the conservation measures will be considered when determining the need for listing the Paradine plains cactus as threatened or endangered under the Endangered Species Act of 1973, as amended (ESA) (16 U.S.C. §§1531-1544). This CCA is conceptually based upon adaptive management principles, is voluntary, and is flexible in nature.

Specifically, this CCA intends to guide conservation measures on public lands managed by the U.S. Forest Service (USFS) and Bureau of Land Management (BLM) by establishing a framework of management actions through collaboration with all of the Cooperators.

2. INTRODUCTION AND PURPOSE

We have not identified significant threats affecting the current status of the Paradine plains cactus. However, potential stressors occurring within its range include extended drought due to climate change, illegal collection, travel management, pesticide and herbicide use, fire suppression, and livestock grazing. In addition, the status of the plant's pollinators is currently unknown.

The Paradine plains cactus was designated as a candidate species under the authority of the ESA on December 15, 1980 (45 FR 82480). Candidate species are plants and animals for which the U.S. Fish and Wildlife Service (USFWS) has sufficient information on their biological status and threats to propose them as endangered or threatened under the ESA, but for which development of a listing regulation is precluded by other higher priority listing activities. Candidate conservation can be facilitated through inter-agency agreements. A CCA is intended to direct specific conservation efforts, to outline management practices that will prevent decline of their habitat, and to ensure regular, periodic review of their status with the goal of working to preclude the need to list the species.

In 1996, the USFWS, USFS, and BLM completed the Paradine Plains Cactus Conservation Assessment and Strategy, and in 1997, these agencies formalized conservation for the species

through a CCA. On October 25, 1999, USFWS published an updated review of plant and animal taxa that were candidates or proposed for listing as endangered or threatened (64 FR 57534). Paradine (Kaibab) plains cactus was removed from candidate status based on a reduction to the degree of threats through development of the 1997 CCA. This document updates the 1997 CCA and revises the conservation goals and objectives to reflect management that has been implemented over the last 18 years.

The Paradine plains cactus is classified under Arizona law as a Highly Safeguarded Protected Native Plant. According to Arizona law, it is unlawful to "destroy, dig up, mutilate, collect, cut, harvest, or take any living highly safeguarded native plant" (Statute 3-900 and Article 11). The law 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. The law does not protect habitat.

The cactus was classified in March 2014 as Endangered by the IUCN (World Conservation Union) Red List of Threatened Species (version 2014.3; http://www.iucnredlist.org/).

This CCA is intended to establish a framework for Cooperator participation and specific actions for the Paradine plains cactus's protection, conservation, management, and improvement of the species' status. This revision of the 1997 CCA will further conservation of the Paradine plains cactus on Federal lands through the following activities:

- Protecting known populations and additional potential habitat by reducing threats to its survival,
- Maintaining its ecosystem,
- Restoring degraded habitat,
- Implementing standard monitoring to evaluate the species status and direct adaptive management, and
- Identifying and facilitating research regarding the biology of and effects to the species.

This CCA is voluntary and flexible in nature and has been developed so that different conservation and management actions that reduce threats to the species can be agreed upon and implemented by each Cooperator within their organization. Through such cooperation in establishment, refinement, and implementation of conservation measures, the Cooperators will continue to reduce the threats to the Paradine plains cactus.

3. GOALS

The goals of this CCA fall into two main categories:

A. Conservation and Management: By addressing Paradine plains cactus conservation across the plant's entire range, the Cooperators will work to conserve and increase Paradine plains cactus populations by:
    - Developing and implementing habitat management strategies that maintain or enhance the species' habitat
    - Monitoring the response of the species to conservation and management initiatives

- Supporting research related to life history, ecology, and distribution/status of Paradine plains cactus populations

B. Cooperation and Collaboration: By managing Paradine plains cactus conservation actions collaboratively, the Cooperators will:
   - Increase consensus
   - Increase scientific rigor
   - Identify and maximize resource availability (i.e., expertise, funds and authority, public outreach)
   - Improve the chances for the species' long-term conservation and survival
   - Enable integration of monitoring and research efforts with habitat management activities (Adaptive Management)
   - Communicate observed effects, management considerations, and research results on a timely basis, and develop annual reports of activities
   - Meet on an annual basis during the winter, to prepare for upcoming monitoring season, review the previous year's results and to coordinate and review implementation of the CCA

By defining, reviewing, and refining the steps necessary to accomplish and ultimately achieve these goals, the Cooperators think that current and potential threats to the Paradine plains cactus will continue to be significantly reduced and that the cactus and a significant portion of its habitat can be conserved. The effect of the conservation measures in this CCA will be considered when determining the need for listing the Paradine plains cactus as threatened or endangered under the ESA. The intent of the CCA is to implement conservation measures that will contribute to improving the species' conservation status with the goal to make listing the species as threatened or endangered under the ESA unnecessary within the foreseeable future.

4. COOPERATORS AND POINTS OF CONTACT

FEDERAL AGENCIES

U.S. Department of Agriculture, Forest Service

Kaibab National Forest, Supervisor's Office
800 South 6th Street
Williams, Arizona 86046
Forest Biologist: Chirre L. Keckler
(928-635-8357, ckeckler@fs.fed.us

Kaibab National Forest, North Kaibab Ranger District
430 South Main Street
P.O. Box 248
Fredonia, Arizona 86022
District Biologist: Angela Gatto
(928-643-8127, agatto@fs.fed.us)

U.S. Department of Interior

Bureau of Land Management
Arizona Strip Field Office
345 East Riverside Drive
St. George, Utah 84790
Special Status Plants Specialist: Jace Lambeth
(435) 688-3242, jlambeth@blm.gov)

Fish and Wildlife Service, Arizona Ecological Services Office
2500 South Pine Knoll Drive
Flagstaff, Arizona 86001
Fish and Wildlife Biologist: Bill Austin
(928-556-2012, william_austin@fws.gov)

5. AUTHORITY

The signatory Cooperators enter into this CCA under federal law. All parties recognize that they each have specific statutory responsibilities that cannot be delegated, particularly with respect to the management and conservation of plants and habitat. Nothing in this CCA is intended to reduce, nullify, or expand, any of the Cooperators' respective responsibilities.

5.1. U.S. Department of Agriculture, Forest Service (USFS)

The USFS is a natural resource management agency responsible for 78 million hectares (193 million acres) of national forest and grasslands in 44 states, Puerto Rico, and the Virgin Islands. The Forest Service Manual (FSM) provides specific direction and guidance for managing rare species on national forests, and allows the Regional Forester to designate species as Sensitive (FSM 2672.11, 2670.44). The Regional Forester has designated the Paradine plains cactus as a Sensitive species. The Paradine plains cactus is also protected as a narrow endemic species under the 2014 Revised Kaibab National Forest Land and Resource Management Plan (USDA 2014).

General objectives for sensitive species include: (1) developing and implementing management practices to ensure that species do not become threatened or endangered; (2) maintaining viable populations of all native and desired non-native wildlife, fish, and plant species and their habitats on national forests and grasslands; and, (3) developing and implementing management objectives for sensitive species and their habitats. The authority to develop the concept of partnerships and enter into specific agreements is outlined in FSM 1580 and 1580.1. Regional Foresters, Station Directors, and the Area Director are designated as signatory officials for cooperative agreements and other FSM 1580 agreements for programs under their jurisdiction (FSM 1580.41d).

5.2. U.S. Department of Interior, Bureau of Land Management (BLM)

The BLM manages more than 245 million surface acres of public lands in the United States. When authorizing land use activities such as recreation, livestock grazing, energy development or forest management, BLM must ensure the needs of wildlife, fish, and plants are taken into consideration. The BLM manages these resources in cooperation with state and other federal agencies. The mission of the BLM's plant conservation and management activities is to ensure that native plants and native plant communities on public lands are managed, conserved, and/or restored for the benefit of present and future generations. The BLM's work in plant conservation and management is done in partnership with all BLM programs and in cooperation with other federal and state agencies, industry, and the American people to achieve its goals. The BLM Manual (6840) identifies special status species as: (1) species listed or proposed for listing under the ESA; and, (2) species requiring special management consideration to promote their conservation and reduce the likelihood and need for future listing under the ESA, which are designated as Bureau sensitive by the State Director(s). The Paradine plains cactus is designated as a special status species. The objectives of the BLM special status species policy are: (1) to conserve and/or recover ESA-listed species and the ecosystems on which they depend so that ESA protections are no longer needed for these species; and, (2) to initiate proactive conservation measures that reduce or eliminate threats to BLM sensitive species to minimize the likelihood of and need for listing of these species under the ESA. This agreement is consistent with 43 U.S.C. §1737(b), Federal Land Policy and Management Act of 1976; 43 C.F.R. §24.6, USDI Fish and Wildlife Policy: State-Federal Relationships (Cooperative Agreements); and BLM Manuals 1786 (Memorandums of Understanding) and 6840 (Special Status Species Management).

5.3. U.S. Department of Interior, Fish and Wildlife Service (USFWS)

The mission of the USFWS is to work with others in order to conserve, protect, and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people. The USFWS is responsible for co-administration of the ESA and for monitoring candidate and species of concern. In 1973, the ESA was enacted for the purposes of conserving threatened and endangered species and preventing their extinction. All federal agencies were called upon to utilize their authorities in furtherance of the purposes of the ESA by carrying out conservation programs for these species. Sections 2, 6, and 7 of the ESA, as well as the Fish and Wildlife Act of 1956 (16 U.S.C. 742a-754) and the Fish and Wildlife Coordination Act (16 U.S.C. 661-667e), authorize the USFWS, in coordination with other Federal and State agencies, to facilitate conservation programs through inter-agency agreements.

6. CCA MANAGEMENT AND ADMINISTRATION

6.1. PARADINE PLAINS CACTUS CCA WORKGROUP FORMATION, ORGANIZAION, AND LEADERSHIP

In order to meet the objectives of this CCA, the Paradine plains cactus CCA Workgroup (PEPAW) will manage, administer, and periodically review this CCA. The PEPAW will consist of one of more designated representatives from each Cooperator participating in this CCA and

may include technical and legal advisors and other members as deemed necessary. The responsibility of this workgroup is to coordinate the implementation and administration of the CCA without superseding the jurisdictional responsibility of any Cooperator. The PEPAW will make recommendations for the conservation, management, and research needs of the Paradine plains cactus. Paradine plains cactus location data will be entered into the USFS's Threatened, Endangered, and Sensitive Plants – Invasive Species database, and information will be exchanged with the Arizona State Heritage Program. Other information and reports regarding the species will be maintained, managed, and distributed within the PEPAW.

6.2. CCA ASSESSMENT AND MANAGEMENT

The PEPAW will be responsible for the coordination of the conservation activities and monitoring of the conservation actions and commitments of the Cooperators to determine whether all actions are in accordance with the CCA. The Cooperators of the PEPAW will develop an annual assessment report of their respective agencies' progress towards implementing the conservation actions described in this CCA. PEPAW members will meet annually to review the progress that the Cooperators have made and discuss recommendations for CCA revisions. Following the annual review, the PEPAW will develop a record detailing the progress made to date on the implementation of the conservation actions described in the CCA.

7. SPECIES INVOLVED

7.1. DESCRIPTION

Paradine plains cactus (*Pediocactus paradinei)* was first collected in House Rock Valley in the spring of 1956 by N. A. Paradine (Benson 1957). It was described by B. W. Benson (1957), who noted that "the plants are striking for the long, white, hair-like spines completely covering the stem apex. The spine texture and arrangement differentiate this plant from any previously reported from Arizona."

Paradine plains cactus is a small, single, green, globose cactus (family Cactaceae). It is usually no more than 40 millimeters (mm) (1.5 inches (in)) tall above ground and half of its stem is underground. Plants can reach diameters of 60-80 mm (2.5-3.0 in). There are 4-6 central spines per aereole. These central spines are white, hair-like, dense, flexible, bristle-like, and 5-7 mm (0.2-0.3 in) long. There are 20 radial spines per aereole, curving spreading, white, and partially obscuring the plants. The flowers are 19-25 mm (0.75-1.0 in) in diameter with cream to pale yellow petals with a pink midrib. The fruit is top-shaped, greenish, and turns tan when ripe. The apex is circumscissile so that it opens like a lid, and the fruit splits down the side at maturity. The tiny black seeds have small tubercles.

Most plants can be easily distinguished in the field, but very young plants can be easily confused with young plants of Arizona beehive cactus (*Coryphantha vivipara*), which occurs sympatrically with Paradine plains cactus. Once the plants flower, Arizona beehive cactus can be distinguished from Paradine plains cactus by the presence of a groove between the spiniferous and floriferous sections of the aereole (Benson 1982). This groove remains evident on the tubercle after the flower falls off. The spines of adult Paradine plains cactus are unique in their

texture and arrangement: long, white, hair-like, flexible, and completely covering the stem apex. Young plants are more difficult to distinguish. Spine arrangement on aereoles of Arizona beehive cactus is more pectinate, with spines parallel to each other along the long axis of the aereole. In Paradine plains cactus, spines are not as neatly arranged and tend not to be parallel, and they may overlap at their tips. Spines of Paradine plains cactus are less robust than Arizona beehive cactus and do not taper toward the distal end. More detailed descriptions can be found in Benson (1961), Heil et al. (1981), Phillips et al. (1981), Benson (1985), and Galeano (1984). Keys to the identification of the species of *Pediocactus* (including Paradine plains cactus) are found in Benson (1961, 1962, and 1985).

7.2. LIFE HISTORY

Paradine plains cacti emerge from winter dormancy as temperatures rise in early spring, usually in late March. By early April, when flower buds are first visible, plants have doubled in height to 20 to 40 mm (0.8 – 1.5 in) above the soil surface. The plants become turgid and vegetative growth occurs. Flowering generally occurs in late April. The plants reach maximum height during fruiting in mid-May. During the arid foresummer (late May-early July) the plants retract into the soil. With the summer rains, the plants again emerge and become green and turgid. In general, the plants remain emergent until early November when they again retract into the ground. Many become flush with the soil surface or retract as much as 10 mm (0.4 in) below the surface and become slightly covered with soil and pebbles. Other species of *Pediocactus* - *P. peeblesianus*, *P. knowltonii*, *P. bradyi*, and *P. winkleri* - also retract below ground to avoid environmental stresses (Heil et al. 1981).

According to Warren et al. (1992), seedlings with cotyledons reach 6 mm (0.24 in) in diameter their first year. They estimated that Paradine plains cactus reaches reproductive maturity at approximately 10 years of age and has a maximum potential life span of greater than 40 years. Flowering success is correlated with plant size: larger plants of reproductive age flower more often and produce more flowers. Tests revealed the plants are self-sterile; that is, they require cross-pollination (Milne 1987). The flowers are open between 0930-1430 hrs. (Milne 1987). Potential pollinators on Paradine plains cactus were identified as bee flies (*Bombyliidae*), hover flies (*Syrphidae*), Hymenoptera, Diptera, and solitary bees (*Andrenidae*) (Milne 1987). Approximately half of the plants that flower do not produce fruit. The average number of seeds per fruit is 16; therefore each plant might produce approximately 320 seeds during its lifetime (a very low number compared to other cacti) (Warren et al. 1992). Many fruit that mature are eaten (Laurenzi and Warren 1988). Studies on other cacti such as saguaro (which produce an estimated 40 million viable seeds in a lifetime) have shown that over 99 percent of the seedlings succumb to animals during the first year, and most of the seedlings that do survive are usually concealed beneath protecting plants or in rocky crevices (Steenbergh and Lowe 1977, Gibson and Nobel 1986).

Paradine plains cactus seeds survive in the soils for a few years (S. Brack pers. comm.). However, successful synchronicity of good seed crops with appropriate weather conditions for germination and seedling survival may require many years to achieve and much is unknown about the germination requirements for this plant. A closely related species, Peebles Navajo cactus (*Pediocactus peeblesianus* var. *peeblesianus*), can germinate in either spring or fall, which

allows the plants to take advantage of rare combinations of favorable conditions whenever they occur (Phillips and Phillips 1995). Fall germination may actually result in a higher level of survival if soil moisture conditions remain favorable for a long period of time during the ensuing winter season. The plants will be 6-8 months old before enduring their first fore-summer drought stress rather than 1-2 months old. In most years, there are significant dry periods in May-June and September-October in the areas where the cactus grows. It has been shown that cactus seedlings can tolerate much longer periods of drought when they are larger (Gibson and Nobel 1986). Paradine plains cactus seedlings, like other cactus seedlings, have a cylindrical shape, which is not as efficient for water economy as a spherical shape (Gibson and Nobel 1986). Only after a few years do the seedlings develop a more spherical shape. Survivorship of seedlings depends upon their not encountering a long dry period before they have reached sufficient size to withstand drought conditions. Occasionally, the death of mature plants has occurred during severe droughts.

Paradine plains cactus plants are colonized by vesicular-arbuscular mycorrhizae (VAM) (Milne 1987; Phillips et al. 1996). VAM probably assist colonized plants with water, nutrient, and mineral uptake and balance. It is typical to find mycorrhizae in very rocky, droughty soil where non-mycorrhizal plants have difficulty surviving. Without this symbiosis, many plants fail to grow past the germination stage or show a decreased growth rate (references cited in Klopatek et al. 1990). The majority of plants that occur in mature pinyon-juniper communities, including juniper without pinyon pine, are colonized with VAM (Klopatek et al. 1990).

7.3. HABITAT

At present, the species is known exclusively from the eastern slopes of the Kaibab Plateau (East Kaibab monocline) and small portions of adjoining House Rock and Coyote valleys in Coconino County (Figure 1). Benson (1982) included northeastern Mohave County within the species' range, but precise locality information is not available and no additional specimens have been located west of the Coconino County line. There is a note concerning a putative sighting on the west side of the Kaibab Plateau (Reichenbacher 1987), but attempts to relocate the site or find other locations in that area have been unsuccessful (Rutman 1988, USFS files 1993, 1994).

Cacti have been found from south of Tater Canyon to the low divide that separates House Rock and Coyote valleys. One concentration has been located in Coyote Valley. Plants have been located within drainages and along canyon bottoms as well as along ridge tops. Drainage ways are characterized by relatively broad valley width and gentle gradient across the platform compared to their headwater sections and downstream sections, both of which are narrower and incised more deeply as they pass through steeper terrain.

Currently, Trail Canyon, Pasture Canyon, Valley Canyon, and House Rock Valley support concentrated groups of cacti. These concentrations can be found scattered for several miles along the canyon bottoms on alluvial, colluvial, and residual surfaces immediately adjacent to the canyon bottom. A number of tributary streams to these drainages, as well as similar but smaller canyons, cross the conservation area and are known to support Paradine plains cactus. There are scattered occurrences widely distributed in the pinyon-juniper woodlands on the ridge tops.

Pinyon-juniper grassland and pinyon-juniper sagebrush vegetation communities occur within the range of the Paradine plains cactus. The pinyon-juniper grassland vegetation community is composed of the pinyon-juniper grassland and juniper grassland vegetation types. Pinyon is occasionally absent, but one or more juniper species are always present. Except in some post-fire communities, these areas historically had at least 10 percent tree canopy cover with an understory dominated by grassland species, often on deep soils with gentle topography. Areas that historically had less than 10 percent tree canopy cover are classified as grasslands. This distinction is necessary for differentiating between vegetation types and their respective desired conditions, but it is recognized that transition between pinyon-juniper grasslands and grassland savanna actually occurs along a gradient. Fires are typically low severity with a 0- to 35-year return interval (Fire Regime I).

In the pinyon-juniper sagebrush vegetation community, sagebrush is the dominant shrub in most areas. This vegetation type may better be described as pinyon-juniper shrublands, but for consistency with the potential natural vegetation types identified for the Southwestern Region of the USFS, they are referred to as pinyon-juniper sagebrush communities. Pinyon-juniper sagebrush communities are concentrated in areas dominated by cold season precipitation regimes. They are usually found on sites with coarse-textured, gravelly, or lithic soil characteristics. Pinyon is occasionally absent, but one or more juniper species are always present. These systems have open woodland canopies interspersed with Colorado Plateau and Great Basin shrub species such as big sagebrush (*Artemisia tridentata Nutt.*), rubber rabbitbrush (*Ericameria nauseosa* (Pall. Ex (Pursh)), fourwing saltbush (*Atriplex canescens* (Pursh) Nutt.), and winterfat (*Krascheninnikovia lanata* (Pursh)). Typical disturbances include fire, insects, and disease. Contemporary disturbances include mechanical removal of overstory trees. Fire absence since Euro-American settlement has not resulted in dramatic increases in tree densities as it has with other woodland types, presumably since fire occurrence may not have been significantly altered in this community type following EuroAmerican settlement. The natural fire regime and desired condition for fire in the area is mixed to high severity with return intervals of 35 to more than 200 years (Fire Regimes III, with occurrences of stand replacing fire at longer intervals).

7.4. DISTRIBUTION AND STATUS

The majority of known occurrences of Paradine plains cactus are on lands administered by the North Kaibab Ranger District (NKRD) of the Kaibab National Forest (Arizona Game and Fish Department 1994). A few occurrences have been known from lands administered by the Arizona Strip District of the Bureau of Land Management, immediately east of the Kaibab National Forest boundary in House Rock Valley and Coyote Valley; however, plants have not been detected since 2005, based on annual surveys through 2014. On BLM-administered lands, habitat occurs within both the Arizona Strip Field Office and Vermilion Cliffs National Monument. The entire known range includes an area of approximately 150 square miles, or 90,000 acres and is shown in Figure 1.

Within this range, the occurrences consist of anything from one isolated individual or relatively small clusters or colonies of varying size to more extensive colonies within areas in which delineation of discrete colonies becomes difficult. Overall, Paradine plains cactus occurrence is patchy. Recent observations have shown that spring surveys are more effective at detecting

plants. Unfortunately, most of the historical and past surveys have occurred in late summer when detection probability is low.

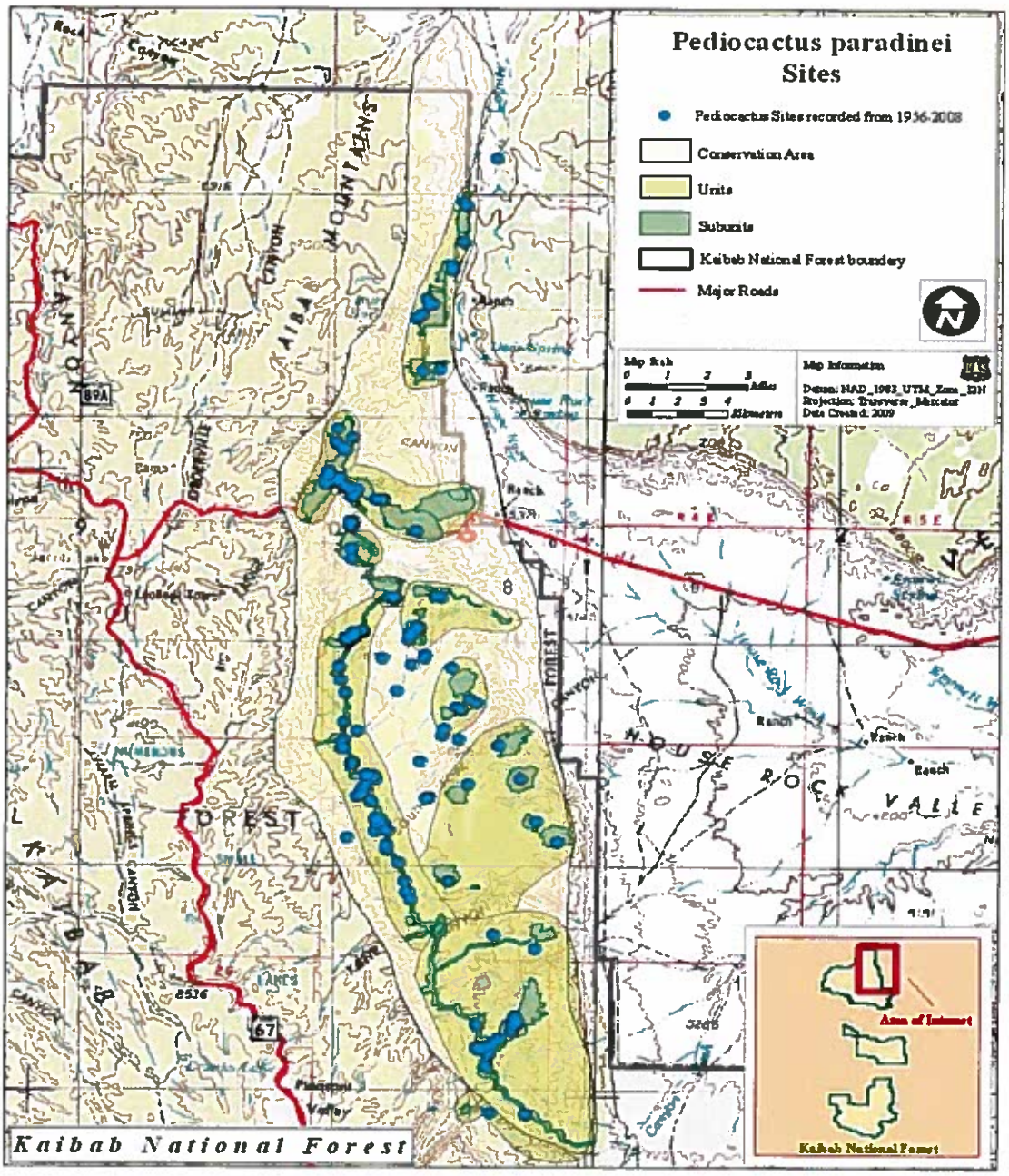

Figure 1. All recorded Paradine plains cactus locations from 1956 to 2014. The conservation area was first delineated in 1988 as a result of the work completed by Laurenzi and Warren and incorporated in the 1996 Conservation Agreement and Strategy. Units are generalized population areas and subunits are areas with actual populations.

Surveys for Paradine plains cactus conducted for the NKRD in 1992-94 qualitatively showed a fairly substantial population of scattered individuals associated with the pinyon-juniper woodland, and this indicated that there might be a correlation between plant distribution and

dripline of trees. Field surveys in July of 2000 showed an apparent sharp decrease in numbers of cacti since 1994, probably due to conditions caused by prolonged drought from 1998 to the summer of 2000 (Phillips et al. 2001). The referenced surveys were conducted outside of peak detectability, and it is unknown what the effect of the drought actually was. The plants that were located showed no statistical correlation between dripline and distribution when both tree species were considered together; however, there was a positive correlation between juniper and Paradine plains cactus distribution on the dripline, and a negative correlation between pinyon and Paradine plains cactus on the dripline (Phillips et al. 2001). Mycorrhizal association may be responsible for the positive correlation of juniper and Paradine plains cactus. The small sample size due to low numbers of plants makes these conclusions preliminary (Phillips et al. 2001).

Surveys for Paradine plains cactus were carried out by Dr. Arthur M. Phillips, III, for the NKRD in the summer of 2000-2001 along a 5.3 mile segment of Forest Road (FR) 220. Eighteen sites were surveyed, half of which were positive, with a total of 121 cacti counted. The species showed a clustered dispersed distribution within the survey area. Five sites included 11 or more cacti, were mapped, and all trees were counted. A cluster of three sites had 87 plants. The 2001 surveys indicated a statistically significant positive correlation of Paradine plains cactus with driplines of pinyon and juniper, although the sample size was small (Phillips 2001).

The BLM re-inventoried total potential habitat on public lands (House Rock Valley) in 2004. In early 2005 four plants were relocated from the 2004 inventory. Later in 2005 these plants were found to have been eaten by wildlife. There have been no plants found on any BLM habitat since 2005, based on annual surveys through 2014. Drought and rodent predation have been identified as the main reason for the lack of plants found within BLM habitat; in addition, very little potential habitat for the species exists on BLM lands - the potential habitat is almost all located on National Forest System lands.

The first 10 permanent plots on NKRD were established by Galeano (1984). Plots were chosen because they had plants and appeared to be representative of the plant's habitat (Laurenzi and Warren 1987). Four additional permanent monitoring plots were established by theUSFS and The Nature Conservancy in 1987 and have been re-read yearly since then by The Nature Conservancy, Dr. Robert Frye, and USFS personnel. In 1999 an additional 5 plots were added for a total of nineteen permanent monitoring plots. Plots were grouped into subunits, subunits were named by geographic features, and mitigation measures were defined specifically for each subunit in 1996. However, the NKRD has applied mitigation measures as necessary across the conservation area. Subunits do not represent any ecological association for the plan and are not being carried forward in this CCA.

The timing of the monitoring of the permanent plots has not been consistent over the years. The best information that the monitoring has given us is to show that direct impacts have not occurred. For the most part, the monitoring that has been conducted has only provided us with presence/absence data and an indication that reproduction does occur. Over time, the stakes in the monitoring plots have been lost and plot centers are unknown. In addition, the monitoring has not provided us an accurate range of the species. Starting in 2014, NKRD personnel have used survey grade GPS and a total station to better inform current status on eight of the current monitoring plots and to monitor individual plants in the plots. Weekly monitoring that begins

immediately after spring snow melt has improved detectability. Although these data have not been thoroughly analyzed, they indicate that the plant is more numerous and widespread than indicated in previous monitoring. For example, in Trail Canyon, the maximum number of plants detected using earlier monitoring methods was 25. In 2015, a total of 504 plants were counted by surveying post-snow melt and using GPS and total station.

Because significant life history information is lacking for this species and we currently do not have data regarding population density, no estimate exists regarding the acreage or population size necessary to support a viable Paradine plains cactus population. However, information collected in 2015 by the USFS indicates that the population size and extent is considerably larger than previously thought, and more information is needed regarding the ecological factors influencing persistence of the species.

7.5. LAND OWNERSHIP

The Paradine plains cactus is currently known to occur on approximately 36,422 hectares (90,000 acres) of Federal lands.

8. THREATS INFLUENCING THE SURVIVAL OF THE PARADINE PLAINS CACTUS

The success of any conservation program is dependent upon eliminating or significantly reducing the impact of threats to a species' existence. The following summarizes the five listing factors identified in section 4(a)(1) of the ESA that must be considered by the USFWS in evaluating current threats to the Paradine plains cactus:

(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.

In addition, identification of the specific threats to the cactus and its habitat provides a framework for implementation of conservation measures to address those threats.
The stressors/threats that are potentially affecting the species status, categorized by the five listing factors above are: fire and fire management (A), invasive species (A), pollination impairment (A), illegal collection (B), ungulate/rodent herbivory (C), and climate change (E). Since the 1997 CCA, a number of threats have been addressed through changes in management on National Forest System and BLM-managed lands. These include range management; recreation and road access; and road construction and maintenance.

8.1. THE PRESENT OR THREATENED DESTRUCTION, MODIFICATION, OR CURTAILMENT OF THE SPECIES' HABITAT OR RANGE

Fire

Fires have affected and can affect Paradine plains cactus in several ways. Fire can directly injure and kill individuals and populations. Fire has resulted in damage and loss of habitat of the species. Abiotic components of habitat have been affected. The composition and density of vegetation within the species' habitat can be modified to the extent that it is no longer functional habitat for the species. Vegetative cover, soil retention, soil moisture, mycorrhizal associations, and other habitat functions can be adversely affected.

Fire management strategies and decisions can result in fire where fire is not appropriate. Fire management ground-based activities can also affect the species. Fireline construction, burnouts, application of fire retardant and water drops, and other human activity in Paradine plains cactus populations and habitat can result in injury and fatality of individuals and damage and loss of habitat. This stressor has been carried over as a threat in the Stressor Matrix (Appendix B).

Changes in the Pinyon-juniper Ecosystem

Parts of the pinyon-juniper ecosystem are currently not meeting their full ecological potential due to past habitat manipulation and management activities. Management actions that have affected this ecosystem include prescribed and managed fire, chaining, seeding, recreation, and predator control. High intensity burns (Warm Fire, Pasture Canyon) have also occurred that have resulted in soil loss in areas of suitable Paradine plains cactus habitat. Relatively recent research (Shaw 1999) indicates that woody plant encroachment is not occurring within the conservation area. Thus, there does not seem to be any need for immediate projects that would be designed to manage pinyon-juniper vegetation.

Range Management

The effect of livestock grazing on Paradine plains cactus habitat is unknown. Any effects may be greater in areas where there is overlap of concentrations of livestock and denser populations of Paradine plains cactus. Therefore, efforts to eliminate or reduce such overlaps may contribute to reducing the effects on habitat. However, effects to habitat could also occur in areas where livestock are less concentrated and Paradine plains cactus are less dense. Thus, continued proper management of livestock grazing coupled with monitoring and research to determine the effects of livestock grazing on Paradine plains cactus habitat are still necessary.

Range improvements should be located outside of Paradine plains cactus populations and outside of habitat where possible. Where current improvements are located within populations and in habitat, means should be developed to eliminate negative effects that could result from maintenance of the structures.

Consideration of the effects of livestock grazing on Paradine plains cactus should be a prime factor in the development of each allotment management plan for grazing allotments that occur

in the conservation area. Each allotment management plan should specifically address how it will eliminate or reduce impacts to the species and provide protection for and improve habitat for the species. On NKRD allotments, all ungulates (including bison) are managed through allotment management plans. On BLM allotments, grazing is managed either through allotment management plans or through stipulations added to grazing permits. Grazing management plans and permits are developed collaboratively with the permittees, resource specialists, and other agencies, and effects are analyzed through the National Environmental Policy Act (NEPA) process. Collaboration with permittees has resulted in effective threat reductions.

Recreation Activities

Recreation and road management can also result in effects to Paradine plains cactus individuals and habitat. The pinyon-juniper woodland is used primarily for dispersed recreational activities such as camping, picnicking, activities associated with hunting, and pinyon-nut harvesting. Individuals crushed and/or uprooted by vehicle wheels have been observed in the past. Foot trails through populations and habitat could result in similar damage. Trails should not be placed in populations. Mass recreation events should not be planned for the conservation area unless it is determined (through the NEPA process) that such events would not result in adverse impacts to the species or its habitat.

Road location and management are prime determinants of where recreation will occur. Through the implementation of the Forest Service's Travel Management Rule, there are no camping corridors authorized on NKRD lands in the conservation area. Within the habitat area, spur roads were identified and their continued use evaluated for resource concerns. These locations were reviewed for their distance to known cactus populations or suitable habitat. There are no spur roads within a ½ mile of known cactus populations or within suitable habitat. All current system roads or user created roads within the conservation area were closely analyzed. Roads that did not access a structure or significant recreation area that travels to or near known cactus populations were removed from the roads system. The Decision Record for this action was signed in September 2012.

There are no designated routes on BLM-administered lands within the conservation area.

Noxious Weeds

Invasive species can displace native vegetation and aggressively dominate a site. If an infestation is left uncontrolled, the ecosystem function can be altered. Invasions of non-native plant species are facilitated by human activity. Many of the management concerns identified in this conservation strategy could facilitate establishment of invasive species in the conservation area. Establishment of invasives can modify habitat to the extent that it is no longer functional for Paradine plains cactus. Invasive species may also compete directly with Paradine plains cactus for resources. This stressor was carried over as a threat in the Stressor Matrix.

Herbicide and Pesticides

Proposals for use of insecticides and herbicides within and adjacent to the ecosystems of Paradine plains cactus have occurred in the past. However, aside from the possible need to use herbicides to treat infestations of invasive plant species, there is probably little real need for other use of pesticides in the conservation area. Use of pesticides should be considered for the conservation area only if there will be no adverse effects to Paradine plains cactus. Any use of pesticides in the conservation area must strictly follow label instructions and guidance that has been developed for appropriate selection and application of pesticides.

Pollinators

Anecdotal evidence of low fruit and seed set in Paradine plains cactus indicates potential problems with pollination sufficiency. Combined with expected impacts to critical pollinators from climate change, losses of native bees and other insects and disruption of synchronization between plant and pollinator life cycle can be expected. This stressor has been carried over as a threat in the Stressor Matrix.

Projects that Require NEPA

These activities may include land use authorization actions, forest product collection, and recreation activities. These projects require a permit or other authority that requires environmental analysis prior to issuance. For actions within Paradine plains cactus habitat, the NKRD and BLM conduct project clearance surveys and develop mitigation to avoid or minimize disturbance to plants and habitat as needed.

8.2. OVERUTILIZATION FOR COMMERCIAL, RECREATIONAL, SCIENTIFIC, OR EDUCATIONAL PURPOSES

Plant Collection

The extent of illegal collection and its effects to the species needs to be determined. An appropriate law enforcement framework and response should be developed. That response will necessarily include educating law enforcement and other personnel about the species and increasing patrols in the conservation area. This stressor has been carried forward as a threat in the Stressor Matrix.

The USFS and BLM will continue to determine when collection is appropriate. Permits for collection are required by State law and Federal policy (see section 8.3). Federal permits for casual collection should not be issued. Collection permits for the species should be issued only for legitimate purposes such as those that will result in necessary research and/or lead to recovery of the species. There can also be legitimate requests for research permits to address biological questions in order to protect and manage the species. This stressor has been carried forward as a threat in the Stressor Matrix.

8.3. DISEASE OR PREDATION

Pediocacti are subject to root rot (Heil et al. 1981, Crosswhite et al. 1995). Root rot may be a factor in reducing populations during very wet years. Frost-heaving can also affect plants by dislodging them (B.Phillips pers. comm. 2012).

As early as 1977, Gierisch reported observations of rodent and insect herbivory on Paradine plains cactus (Laurenzi and Warren 1988). Other observers also noted the impact of rodent predation (R. Fletcher cited in Laurenzi and Warren (1988), Galeano (1985)). Laurenzi and Warren found six rodent excavations, with a decrease in number of plants in a plot between 1985 and 1987, and Gierisch also reported many apparent rodent holes in 1987 (Laurenzi and Warren 1988). Consumption by wildlife is believed to be the main impact in the loss of cactus on BLM lands (L. Hughes pers.comm. 2012).

8.4. THE INADEQUACY OF EXISTING REGULATORY MECHANISMS

The plant was removed from the list of candidate species in 1999 based on a reduction to the degree of threats through development of the 1997 CCA. Because the plant does not have any regulatory protections under the ESA, the continued management and protections afforded by the CCA through other Federal and State regulatory and policy processes have continued to be effective in reducing threats to the species described in the other factors. The following is a summary of these mechanisms. Insufficient regulatory protection has not been identified as a current threat to Paradine plains cactus.

Kaibab NF Land Management Plan

The KNF has revised the Land Management Plan (USFS 2014). This plan establishes the conservation area as a management area with its own desired conditions and guidelines. It is also described under the desired conditions and guidelines for rare and endemic species on the forest. Other desired conditions, standards, and guidelines provide protection for the cactus.

Arizona Strip BLM Resource Management Plan

Paradine plains cactus is considered a BLM sensitive species; the two applicable Resource Management Plans (for the Arizona Strip Field Office and Vermilion Cliffs National Monument) list the following management actions:

- Participation in conservation efforts for special status plant species will continue.
- Special status plant habitat will be preserved, protected, and managed.
- Monitoring efforts for special status plant populations within the Arizona Strip Field Office and Vermilion Cliffs National Monument will continue.
- A program of public conservation education and planning directed towards preservation of special status plant habitat will be carried out. An example has been the Brown Bag Lunch/Talk series.

State Regulation for Plant Collection

Paradine plains cactus is classified under Arizona law as a Highly Safeguarded Protected Native Plant. According to Arizona law, it is unlawful to "destroy, dig up, mutilate, collect, cut, harvest, or take any living highly safeguarded native plant." (Statute 3-900 and Article 11). The law 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. The State does not have jurisdiction on Federal lands where the majority of the species habitat occurs.

National Regulation (CITES)

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is an international agreement between governments with the aim to ensure that international trade in specimens of wild animals and plants does not threaten their survival. This plant is protected by CITES; it is considered an "Appendix I species", which includes species threatened with extinction. Trade in specimens of these species is permitted only in exceptional circumstances. A specimen of a CITES-listed species may be imported into or exported (or re-exported) from a State party to the Convention only if the appropriate document has been obtained and presented for clearance at the port of entry or exit.

8.5. OTHER NATURAL OR MANMADE FACTORS AFFECTING ITS CONTINUED EXISTENCE

Climate Change

It is unknown how the effects of climate change may manifest in the conservation area and vicinity. However, it has been predicted that the climate of the area will become increasingly hotter and drier.

It may not be possible to do much at a local level to influence the causes or effects of climate change. However, it will be very important to anticipate, detect, and recognize the effects that may be a result of climate change. Most importantly, it will be of vital importance to eliminate or reduce the effects of other human-caused activities that can be synergistically exacerbated by climate change. The adverse effects of those non-climate change factors need to be reduced to the greatest extent possible if Paradine plains cactus is to persist. For example, steps can be taken to seed-bank the species and conserve restoration options if it should later be determined that augmentations and increases in numbers of plants might be needed to support resilience and adaptability of the species to a changing environment. This stressor is carried over as a threat in the Stressor Matrix.

Natural Factors

Other natural factors that could affect the continued existence of Paradine plains cactus include flood, natural erosion, long-term drought, and community changes. None of these stressors have yet been identified to be a significant direct affect, but may need to be considered and appropriately addressed in the future.

9. CONSERVATION STRATEGY COMMITMENTS

The commitments and actions described in this CCA focus on targeting conservation improvement and management of the Paradine plains cactus' status and its habitat to directly address identified threats. Specifically, the Cooperators are using the best scientific information available to focus specific actions that directly influence the impact of identified threats within habitat for the cactus (Appendix B). Because each of the Cooperators is bound to certain guiding agency/entity requirements based on mission, goals, and responsibilities, the landscape and local level conservation actions (Subsection 9.2) are intended to be adaptable and implemented by all Cooperators in accordance with their individual missions. All Cooperators will seek funding for carrying out the conservation actions identified below and will collaborate on cost-sharing opportunities when possible. All funding commitments made pursuant to this CCA are subject to budget authorizations and approval by the appropriate agency. The PEPAW will meet on an annual basis to evaluate the activities identified below and determine their effectiveness in conserving the Paradine plains cactus. Cooperator-specific conservation actions can be found in Subsection 9.3. Appendix B links specific land-management Cooperator actions directly to currently identified threats and provides a mechanism for reporting the impact of those actions.

The occupied areas identified in the CCA will be protected to the maximum extent possible. Adverse impacts to the species will be avoided, and beneficial management activities will be continued or implemented. In consideration of the premises of this document, the respective responsibilities and provisions of each Cooperator are as follows:

9.1. HABITAT CONSERVATION COMMITMENTS

9.1.1. Landscape Level Conservation

This section describes the general conservation actions that all Cooperators agree to implement at the landscape level in accordance with their individual missions. These broad actions include:

- Protect and maintain existing Paradine plains cactus populations and habitat.
- Within the Paradine plains cactus conservation area (the range of the species), the composition, structure, and natural processes of the ecosystems will be protected and maintained to ensure viable populations.
- Identify the extent of the range, distribution, and abundance of the species.
- Address the potential opportunities for sustaining viable populations of Paradine plains cactus within the context of conservation and enhancement of the pinyon-juniper ecosystems in which they occur.
- Plan, develop, and conduct management activities, actions, and projects to eliminate or reduce human-caused impacts to the species to the greatest extent possible.
- Using the new monitoring techniques, identify the status of populations that have been considered to be extirpated, especially on the edges of the species range.
- Support research opportunities with Cooperators or other interested groups (universities, independent researchers, etc.).

9.1.2. Local Level Conservation

This section describes general conservation efforts that all Cooperators agree to implement at the local level, in accordance with their individual missions. These site-specific efforts and actions include:

- For Federal projects, consider the effects of actions, including land management activities, on the Paradine plains cactus during the planning process, avoid or minimize impacts to habitat, and assess such impacts in NEPA documents.
- For ongoing federal activities consider the effects of actions on the Paradine plains cactus and avoid or minimize impacts to individuals and habitat.
- Provide for review to the Cooperators any management plans, proposed strategies, reports, or other documents under the Cooperator's purview that may affect Paradine plains cactus recovery.
- Train personnel to properly identify the cactus and to report sightings to their PEPAW representative.
- PEPAW representatives will compile and keep records of all Paradine plains cactus observations/occurrences on land they manage. These data will be shared with the PEPAW for inclusion into the USFS Threatened, Endangered, and Sensitive Plants – Invasive Species and Arizona State Heritage databases.
- Conduct surveys to document Paradine plains cactus presence and distribution.

9.2. CONSERVATION ACTIONS SPECIFIC TO EACH COOPERATOR

9.2.1. U.S. Department of Agriculture, Forest Service, Kaibab National Forest

- Livestock Grazing: Management actions have been and will continue to be implemented through Annual Operating Instructions or long-term Allotment Management Plans. Direct actions and monitoring to avoid degradation of vegetation on each allotment are dealt with on an allotment-by-allotment basis. NKRD has identified water and salt placement to avoid plants. Grazing activities are timed to avoid impacts during critical reproductive periods.
- Travel Management: This area was closed to cross-country travel, and no corridors were included. NKRD biologists work closely with Law Enforcement and Forest Protection Officers in implementing the Travel Management Rule to prevent degradation of vegetation and direct impacts to Paradine plains cactus.
- Forest Management and Activities: All projects on the District are evaluated during the NEPA process and actions that will occur in the conservation area are mitigated. Some examples include:
    - Wood cutting is not allowed in the conservation area.
    - Big game retrieval is not allowed in the conservation area.
    - During culvert construction on Trail Canyon, NKRD worked closely with Arizona Department of Transportation to avoid downstream effects to Paradine plains cactus.
    - When herbicides are necessary, dye is used within the herbicide to avoid non-target species.

    - USFS has a permit process in place with population protection measures for legal plant collection and will be directing the permittee based on items identified by the PEPAW.
    - Forest Service personnel work with Law Enforcement and Forest Protection Officers to avoid illegal collections.
- Continue monitoring and learning about life history and habitat needs of Paradine plains cactus.

9.2.2. U.S. Department of Interior, Bureau of Land Management

- Continue monitoring past Paradine plains cactus locations each year or when monitoring of other listed or rare plants occurs in and near House Rock Valley.
- Travel Management: The habitat area is closed to cross-country travel. BLM staff work closely with Law Enforcement Officers in implementing the Travel Management Plans to prevent degradation of vegetation and direct impacts to Paradine plains cactus.

9.2.3. U.S. Department of Interior, Fish and Wildlife Service

- Continue to monitor and report the status of the Paradine plains cactus, as required by Congress and current policy. Report implemented and proposed conservation efforts and the status of the cactus at the annual Paradine plains cactus PEPAW meeting.
- Review and comment on any project proposals that may impact the Paradine plains cactus.
- Work with Cooperators on methods to reduce adverse impacts associated with any proposed project or activity that could adversely affect the Paradine plains cactus or habitat covered by this CCA. Update or modify this CCA as needed to ensure that adaptive management practices are implemented.
- Pursue funding opportunities to help support the activities of the other Cooperators.

10. ADAPTIVE MANAGEMENT

This CCA is based on adaptive management principles. All Cooperators agree and recognize that implementation of the conservation actions included in this CCA will be considered consistent with the concepts of adaptive management. The effectiveness of all conservation measures and monitoring methods will be reviewed by the Cooperators at the annual PEPAW meeting. Based upon such evaluation, appropriate modifications to the management scheme, through the PEPAW, will be incorporated to further enhance the goals of this CCA.

11. RESEARCH NEEDS

The following research needs have been identified by the Cooperators in order to continue to alleviate negative effects related to the identified threats to the species: wildfire and fire management, proliferation of noxious weeds, status of pollinators, plant collection, and climate

change. By conducting research studies related to the biological and ecological functions of the species, information gained from these studies will be used in the adaptive management program to modify management as needed to meet the goals of this CCA. Research needs are listed in order of priority as determined by the Cooperators.

1. Conduct basic research on the biology and ecology of Paradine plains cactus. Research topics should include determining:
    - The genetic variation among populations and between populations
    - The quality of seeds produced
    - The conditions for seed germination and seedling establishment
    - The extent and effect of seed predation
    - Seedling survival rates
    - The role of mycorrhizae in seedling establishment and health of individuals
    - The role of nurse plants
    - Diseases and their effects
    - Pollinators and pollination ecology

2. Conduct research that will increase understanding of the Paradine plains cactus ecosystem. Factors that should be investigated include:
    - The biological and physical environments
    - Soils that the populations occur in
    - The topography that is associated with the species
    - Climate and microclimates that occur within the range of the species
    - Small- and large-scale disturbances
    - The direct and indirect effects of drought on individuals and populations

3. Continue to collect and summarize existing current knowledge about the species so that it can be used as baseline data in future climate change monitoring and research.

4. Conduct controlled studies on climate change and its effects on the species. Aspects that should be investigated include:
    - Assess how climate change may affect the occurrence or distribution of Paradine plains cactus along various gradients or in other areas
    - Assess how climate change may affect the occurrence and distribution of pollinators of Paradine plains cactus
    - Assess how climate change may affect the maintenance of the association of Paradine plains cactus with various mycorrhizae
    - Assess how climate change may facilitate establishment of invasive species

5. Support research towards understanding the role of herbivory on Paradine plains cactus plants and seeds and the type and extent of herbivory occurring.

6. Conduct research on the effects of fire on Paradine plains cactus and its ecosystems.
    - Investigate the effects of fire on Paradine plains cactus and its associated vegetation communities within the Warm Fire area. Conduct research to examine the natural recovery and reestablishment of plant populations and effects of

sedimentation or soil loss as a result of fires. Specific areas of study should focus on the Trail Canyon, Valley, and Warm Fire populations. This information should also be used to inform future management treatments within the pinyon-juniper and shrub/grassland communities.

- Conduct a comparative re-inventory of populations and individuals
- Conduct long-term monitoring of recovery post-fire
- Conduct long-term monitoring of associated plants and habitat
- Assess the effectiveness of post-fire reseeding and cheatgrass control treatments
- Document any changes to ungulate populations/use areas post-fire

7. Assess the effects of fire on mycorrhizae in soil. Studies in sagebrush/ grassland communities indicate that prescribed burns can seriously impact the mycorrhizal component and favor increases in the introduced noxious cheatgrass (Prendusi pers. comm., 1996).

8. Assess the effects of fire retardant on Paradine plains cactus and associated species. Research has indicated that the effects of nitrogen in fire retardant tend to favor non-native and/or nitrogen loving species, which might not be the same as the associated species for Paradine plains cactus existing in the area before the fire.

9. Examine the effects of season of burn, burning prescription, intensity of burn, opening size, number and distance between openings, and fuel loading on effects to Paradine plains cactus habitat.

10. Examine the effects of livestock and ungulate grazing on Paradine plains cactus including grazing season of use and intensity; and effects to flowering, associated herbaceous plants, and pollinators.

11. Examine the response of Paradine plains cactus to spread and establishment of invasive plants and control measures (e.g., mechanical and herbicide treatments).

12. CCA DURATION, RENEWAL, AND REVIEW

Long-term protection and management, as outlined in this CCA, are needed for the continued conservation of the Paradine plains cactus. The initial duration of this CCA is five (5) years following the date of the last signature below, and the CCA will be automatically extended for another five-year term, unless terminated before the date of the renewal by written notice from any cooperator.

The PEPAW will annually review the CCA and its effectiveness to determine whether revision is needed. A five-year review will be conducted to determine if the CCA should be extended. Any Cooperator may propose modifications to the CCA outside the annual review period and by providing written notice to the other Cooperators. Any such notice will include a statement of the proposed modification and the rationale for the revision. The non-petitioning parties will make every effort to respond to the proposed modification, via written notice, within thirty (30) days of

receipt of such notice. If all parties agree that the modification is warranted, then the change will become effective immediately.

If some portion of this CCA cannot continue to be carried out or if cancellation is desired, the Cooperator requesting such action will notify the other Cooperators within thirty (30) days of the changed circumstance.

13. EFFECT OF THE CCA IN EVENT OF LISTING

The conservation and management commitments made in this CCA will be considered during the process of determining whether listing is necessary under the ESA. It is the intent and expectation of the Cooperators that the execution and implementation of this CCA will reduce threats and improve conservation of the Paradine plains cactus.

14. DUPLICATE ORIGINALS

This CCA may be executed in any number of duplicate originals. A complete original of this CCA shall be maintained in the official records of each of the Cooperators.

15. MODIFICATION OF THE CCA

Any party may propose modifications or amendments to this CCA by providing written notice to, and obtaining the written concurrence of, the other Parties. Such notice shall include a statement of the proposed modification, the reason for it, and its expected results. The Parties will use their best efforts to respond to proposed modifications within 60 days of receipt of such notice. Proposed modifications will become effective upon the other Parties' written concurrence.

16. TERMINATION

Any party to this CCA may terminate its participation at any time by providing 30 days written notice to all other parties.

17. AVAILABILITY OF FUNDS

Implementation of this CCA is subject to the requirements of the Anti-Deficiency Act and the availability of appropriated funds. Nothing in this CCA will be construed by the Parties to require the obligation, appropriation, or expenditure of any funds from the U.S. Treasury. The Parties acknowledge that they will not be required under this CCA to expend any Federal agency's appropriated funds unless and until an authorized official of that agency affirmatively acts to commit to such expenditures as evidenced in writing.

18. NO THIRD-PARTY BENEFICIARIES

This CCA does not create any new right or interest in any member of the public as a third-party beneficiary, nor shall it authorize anyone not a party to this CCA to maintain a suit for personal injuries or damages pursuant to the provisions of this CCA. The duties, obligations, and responsibilities of the Parties to this CCA with respect to third parties shall remain as imposed under existing law. This CCA is not a contract, Federal rule or regulation, and it should not be considered to be a final Federal agency action.

Appendix A: SIGNATURE PAGE

CANDIDATE CONSERVATION AGREEMENT

For the
Paradine plains cactus
Pediocactus paradinei B.W. Benson
September 2015

The parties identified herein have established this Paradine plains cactus CCA to be executed as of the date of the last signature below.

STEVEN L. SPANGLE, Field Supervisor — 9/8/15 DATE
U.S. Department of Interior, Fish and Wildlife Service
Region 2, Arizona Ecological Services Office

BILL WESTBROOK, Acting Forest Supervisor — 9/10/15 DATE
U.S. Department of Agriculture, Forest Service
Region 3, Southwestern Region, Kaibab National Forest

TIMOTHY BURKE, District Manager — 9/28/15 **DATE**
U.S. Department of Interior, Bureau of Land Management
Arizona Strip District

Appendix B: STRESSOR/ACTION MATRIX

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	**STRESSOR**	**Cooperator**	**Scope**	**Immediacy**	**Intensity**	**Exposure**	**Response**	**Overall Threat Level**	**CONSERVATION MEASURES**	**ACTIONS NEEDED**	**MEASURES OF SUCCESS**	**ANNUAL REPORTING METRIC**	**ONGOING AND PLANNED ACTIONS**
2	**A. Present or threatened destruction, modification, or curtailment of the species habitat or range** - Expected stressors that may reduce the absolute quantity of habitat, arrangement of habitat, the connectivity of habitat units, and the quality of habitat, etc.												
3	**A.1 Fire Suppression**												
4		KNF BLM	VS-L	F	M	Si	BNI	L	Resource Advisors (RA) trained in *P. paradinei* identification will work with Fire Operations during the fire and provide GIS files of plant locations to the appropriate staff	Provide guidance in the annual resource advisor guide.	RA able to report back to District personnel regarding *P. paradinei* protection	Report to PEPAWG	
5		KNF	VS-L	F	M	Si	BNI	L	Prior to making a decision to move forward with a fire, fuel and climatic conditions should indicate that there is a high probability of low to moderate fire severity.	Communication between Resource Duty officers, resource staff, and line officer.	Post-fire effects are low to moderate fire severity within the Conservation Area.	Report to PEPAWG	
6		KNF	VS-L	F	M	Si	C	L	Containment lines will be discouraged in *P. paradinei* conservation area, unless absolutely necessary to protect human life and safety or valuable property. Existing roads will be utilized for containment lines, whenever possible. Containment lines will not be constructed through existing *P. paradinei* monitoring plots	Communication between the FMO and/or IC, resource staff, and line officer.	No fire lines constructed in conservation area	Report to PEPAWG	Note if fire lines were established in conservation area, document the reasons why and the extent of disturbance and effect to *P. paradinei*
7		KNF	Sm-L	F	L	Sm	BNI	L	If a containment line is necessary, an individual with a fire red card and trained to identify and survey *P. paradinei* will walk in front of any bulldozer or hand line in order to ensure that plants are avoided.	Provide guidance in the annual resource advisor guide.	RA able to report back to District personnel regarding *P. paradinei* protection	Report to PEPAWG	

	A	B	C	D	E	F	G	H	I	J	K	L	M
8		KNF	M-S	F	M	M	BNI	L	To mitigate soil erosion on steep slopes post-fire, KNF will use weed-free wattles to protect plants and habitat where there is a significant potential for erosion.	Work with BAER Team to determine where wattles may be needed.	Post-fire monitoring indicates reduced erosion in *P. paradinei* locations and habitat.	BAER Report	
9		KNF BLM	M-S	F	M	M	BNI	L	Post-fire seeding should be conducted only with native species from the same vegetation type and only at times that will actually be effective for establishment of those species	Work with BAER Team to determine need and seed source for seeding.	Post-fire monitoring indicates soils are stabilized and native species persist. If a non-native seed mix was used for initial stabilization, there is no persistence of those species.	BAER Report.	Ongoing monitoring fate of non-natives beyond BAER activities.
10	**A.2 Invasive Species**												
11		KNF	Si-L	F	L	Sm	BNI		Avoid direct application of herbicide to P. paradinei during any treatments in conservation area.	Conduct a survey of plants during April. Identify and mark *P. paradinei* for avoidance prior to treatment.	No detections of blue dye on *P. paradinei* plants due to herbicide application.	Annual monitoring report.	
12		KNF	Si-L	I	L	Sm	B		Conduct invasive species surveys annually within the conservation area during *P. paradinei* monitoring as well as road surveys to identify new invasion of non-native species, expansions of existing populations, and priorities for removal.	Mechanical or chemical removal of non-natives in priority areas for treatment.	Monitoring indicates establishment and expansion of invasive species has been limited within the conservation area.	Document in Forest Service TESP-IS database and report to PEPAWG	
13	**A.3 Lack of Pollination Services**												
14		KNF	Sm	F	H	Si	BNI	L	Determine by fruitset if pollination of *P. paradinei* is impaired	Monitor plants to compare flowering to fruiting. Record and identify floral visitors.	Fruitset is detected; data detects success of pollination.	Report to PEPAWG	It would be ideal to have 3 years of observation.
15	**B. Over utilization for commercial, recreational, scientific, or educational purposes** - Expected stressors that result in direct and incidental take for commercial, recreational, scientific, and educational purposes.												
16	**B.1 Illegal Collection**												

	A	B	C	D	E	F	G	H	I	J	K	L	M
17		KNF	I	F	L	Sm	C	M	Education of law enforcement (LE) and Forest Protection Officers (FPO) about *P. paradinei* and locations for protection	Work with LE and FPOs	LEs and FPOs are tracking suspicious behavior in the conservation area	Number of LE contacts made within the conservation area	District Biologist and LE/FPOs communicate regarding *P. paradinei*
18	**B.2 Collection Under Permit**												
19		KNF	I	F	L	Sm	C	L	Permits for casual collection should not be issued.	Do not issue permits for casual collection.	Permittee reports and vouchers indicate that permits issued were for legitimate purposes.	List of permittees provided to PEPAWG.	Track violations vs. compliance.
20		KNF BLM	I	I	L	Sm	C	L	NKRD and BLM will determine whether the request for plant collection of Sensitive Species is appropriate. Collection permits for the species should be issued only for legitimate purposes such as those that will result in necessary research and/or lead to recovery of the species.	Have PEPAWG review proposals. NKRD will share permit requests with PEPAWG to validate request. Include protection measures for PEPA in permit amendment.	Permittee reports and vouchers indicate that permits issued were for legitimate purposes.	Reports from permit holder shared with PEPAWG.	Encourage compliance with reporting requirements in issued permits.
21	**C. Disease and predation** - Diseases and predators that are suspected of decreasing population viability.												
22	**C.1. Herbivory**												
23		KNF	Sm	H/F	L	Sm	BNI/C	L	Record observations of herbivory to determine the extent of effects on individual plants.	Collect data on herbivory during *P. paradinei* monitoring.	Include data on herbivory in annual report.	Number of plants/estimated percentage of population damaged by herbivory.	
24	**E. Other natural or manmade factors afecting the species' continued existence** - Stressors that cannot be listed under one of the above categories.												
25	**E.1. Climate Change**												
26		KNF	M_L	F	L/M	M	B/BNI	L	Manage vegetation encroachment within the conservation area.	Identify need for vegetation management projects within the conservation area. Design project in conjunction with PEPAWG.	Acres treated to reduce encroachment.	Report to PEPAWG.	

	A	B	C	D	E	F	G	H	I	J	K	L	M
27		KNF FWS	M	F	M	M	B/BNI	L	Review the condition of the conservation area periodically and make any necessary adjustments to ensure that it will continue to provide climate refugia, corridors or networks of reserves particularly along appropriate gradients, and suitable habitat as the ecosystem is altered by climate change.	Annual review of conservation area boundary based on monitoring.	Conservation area boundary reflects species distribution.	Discussion in PEPAWG.	Forest Plan Amendment would be needed to adjust the conservation area boundary. Polygons in TESP-IS would also need to be adjusted.
28		KNF	M	F	M	M	B/BNI	L	Continue to reduce non-climate stresses on the species to the greatest extent possible in order to reduce the synergistic multiplier effects of climate and non-climate stresses. Implementation of action items addressing non-climate stresses are critical to ameliorating climate stresses that may not otherwise be addressed.	Identify any additional actions needed to reduce non-climate stresses to *P. paradinei* and its habitat.	Removal of stressors and/or progress towards removal of effects to *P. paradinei*.	Planned agenda and discussion item at PEPAWG meeting.	
29		KNF	Si	F	L	M	B/BNI	L	Integrate consideration of climate change as a factor in the design and implementation of monitoring for the species. Track the monitoring and research conducted for species in similar systems regarding climate change in order to obtain relevant information that can be used for adaptive management of this species.	Gather together relevant information to incorporate into ongoing activities.	Climate change factors incorporated into monitoring.	Examples of documents incorporating climate change factors (action designs, monitoring, etc.)	Possible changes to timing of monitoring and pollinator information.

	A	B	C	D	E	F	G	H	I	J	K	L	M
30		KNF	M	I	M	M	B	L	Establish and maintain a seed bank to provide a buffer against extinction if events cause the loss of natural populations.	Individually conserve seeds from each natural population. Collect seeds for garden propagation or storage only when fruit production is sufficient to withstand collecting. Maintain seed in an appropriate research facility designed for long-term storage. Identify partners to assist with seed collection.	Genetically representative seed sample is in secure storage and available for future research and restoration needs.	Number of seeds collected and stored.	Re-sample in aberrant years. Monitor seed viability in storage.
31	**MONITORING AND EVALUATON OF CONSERVATON STATUS**												
32		KNF BLM							Continue monitoring of trend plots with current protocol (i.e., using the GPS and total station) or modify protocol as data informs monitoring.	Follow protocol and conduct surveys at appropriate time.	Number of plots monitored.	Report to WG	Protocol needs to be updated and shared annualy with WG.
33		KNF BLM							Determine extent and abundance of *P. paradinei* populations.	Survey the extent of plants within the conservation area. Identify suitable habitat outside of conservation area.	Conservation area surveyed.	Report to PEPAWG on amount of conservation area surveyed.	
34		KNF BLM FWS							Determine future monitoring objectives based upon extent of population and other factors as determined by the PEPAWG.	Review annual monitoring report to determine future needs. Adjust monitoring protocol as needed.	Areas/plants monitored.	Discussion in PEPAWG	
35													
36	**Notes:**												
37	1. Stressor - a process or event having a negative impact on the SDT. Stressors are grouped into the five listing/delisting criteria.												
38	2. Scope - the geographic and temporal extent of the stressor. The following are used to describe geographic extent: "I" (Insignificant - stressor's geographic extent negligible); "Sm" (Small - <10% of population's potential range); "M" (Moderate - 11-30% of population's potential range); "Si" (Significant - 31-60% of population's potential range); or "VS" (Very Significant - > 60% of population's potential range). The following are used to describe temporal extent: "L" (Long-term - stressor expected to be persistent without intervention); or "S" (Short-term - stressor expected to dissipate on its own with <5-10 years).												
39	3. Immediacy - the action time frame of the stressor. The following are used to describe immediacy: "F" (Future - effects anticipated in future); "I" (Imminent - effects occurring now); or "H" (Historic - effects already realized, but restorative action necessary).												

	A	B	C	D	E	F	G	H	I	J	K	L	M
40	4. Intensity - the strength of the stressor itself to harm the species. The following are used to describe intensity - "L" (Low - minor reductions in range or vital rages [survival and reproductive capacity]), "M" (Moderate - reductions in range or vital rates), or "H" (High - severe reductions in vital rates).												
41	5. Exposure - the extent to which a target resource or individual SDT and stressor actual overlap in space and time; the level of the total population exposed to stressor. The following are used to describe exposure: "I" (Insignificant - level of exposure negligible), "Sm" (Small - <10% of population exposed), "M" (Moderate - 11-30% of population exposed), "Si" (Significant - 31-60% of population exposed), and "VS" (Very Significant - >60% of population exposed).												
42	6. Response - the change in the species' behavior, reproductive capacity or survival due to a specific stress; level of physiological/behavioral response to exposer to stress. The following are used to describe response: "B" (Behavioral - startle, displace, etc), "BNI" (Basic Need Inhibited - capacity to meet basic needs of feed/breed/shelter altered, possibly reducing growth or vital rates), "C" (Confirmed mortality or identifiable reduction in individual growth or vital rates), or "S" (Significant mortality or reduction in individual growth or vital rates).												
43	7. Overall Threat Level - the integration of the scope, immediacy, and intensity of the stressor with the exposure and response of the species measured at the population or species level. The following are used to describe the overall threat level; "L" (Low - no action needed at this time), "M" (Moderate - action is needed), "H" (High - immediate action is needed), or "S" (Severe - immediate action is essential for survival of population.												

Appendix C: MANAGEMENT ACTIVITIES IN PARADINE PLAINS CACTUS RANGE

This section summarizes the USFS and BLM management actions from 1996 to the present specifically taken on behalf of the Paradine plains cactus to address known or potential effects to the species.

Heritage Resources

In 1996, when the Paradine plains cactus Conservation Agreement and Strategy was approved, approximately 3,234 acres within the assessment area had been surveyed for heritage resources yielding 122 sites. Currently 9,610 acres have been inventoried with 336 sites officially documented within surveyed areas. The identification of cultural sites provides added protection to plants and habitat because management is limited in areas with cultural sites. These areas may not be occupied by the plant, but the added protection may allow for plant expansion. New surveys are primarily associated with post-fire inventories, non-project inventories, and small range and wildlife developments. Surveys continue to reveal an overall high site density throughout the conservation area. Site types are consistent with those noted during the 1996 assessment, with the addition of historic period Navajo pinyon gathering camps. The majority of sites are prehistoric in age. Formative period agriculturalist habitation sites and associated agricultural features are the dominant site types. This pattern is expected to continue across much of the assessment area.

Permitted Livestock Grazing

There are five USFS livestock allotments that overlap with the conservation area. Many of the actions of the 1996 Conservation Assessment and Strategy relating to livestock have been and continue to be implemented. These items include:

1. Manage ungulate grazing and browsing within the habitat so that no long-term detriment to the species occurs. Defer livestock grazing until at least July 15 in any pasture where concentrated livestock use would impact Paradine plains cactus during its spring emergence and reproductive cycle.
2. Confine future water developments on the Burro, House Rock, Central Summer, and Kane Allotments to areas beyond 0.5 miles of known populations.
3. Do not place mineral supplements within 0.5 miles of known populations.
4. Develop allotment management plans for the Burro, Central Summer, House Rock and Kane Allotments that implement utilization standards and other appropriate measures to ensure allotments do not degrade vegetation conditions.
5. Develop thresholds of acceptable impacts to watersheds where ungulate management is concerned because of the potential impact to Paradine plains cactus from direct, indirect, and cumulative effects.
6. Any trailing of livestock through the conservation area will need to follow the North Kaibab Ranger District Paradine plains cactus survey and cattle trailing criteria (see project record).
7. Implement a 40 percent utilization rate on all grasses, forbs, and shrubs.

These actions are implemented through Annual Operating Instructions or long term Allotment Management Plans.

Recreation

Trail Canyon

Although Trail Canyon is not listed or maintained as a trail, it may receive minimal use by recreationists travelling on foot. Access is limited by a gate that blocks the road to where the foot portion starts. Although an official forest closure for vehicular travel was not put into place before 2012, the gate has been effective in keeping vehicles out. The road was closed during the travel management process, discussed below. Very little recreation of any kind is evident in the area, and monitoring of the long-term plots has not indicated impacts to plants from recreation by foot.

Travel Management

The NKRD began the Travel Management Rule Analysis in 2009. The Environmental Assessment and Decision Notice to implement the Travel Management Rule was signed September 2012. First and foremost, Travel Management limits cross-country travel. The NKRD analyzed many of the roads and known dispersed campsites inside the conservation area to determine whether they should remain open or be officially closed. The decision limits dispersed camping to beyond ½ mile of known plots or individuals, limits big game retrieval (to buffalo and elk), limits the pull-off corridors within the conservation area to 30 feet, and closes the Trail Canyon road.

Free maps for Travel Management are available to the public. Some roads, including those that are for administrative uses, will continue to exist on the ground but are not included on the maps. Funding limits the amount of road that will be physically closed; however, maintenance will not occur on roads identified as closed. In addition volunteers may be utilized to rehabilitate old roads. In areas where Paradine plains cactus exist, roads have been signed to avoid even the use of the road corridor. Travel Management will be enforced by the USFS, and when there is evidence of egregious resource damage Arizona Game and Fish Department (AGFD) law enforcement personnel will also enforce the NKRD's Travel Management.

Since Travel Management limits cross-country travel, this will reduce some access that may result in impacts from non-commercial recreational activities including, but not limited to hiking, horseback riding, and pinyon nut gathering. Although long term monitoring plots have not shown impacts from these activities, the activities could occur within the conservation area. For commercial activities, including organized motocross races, special forest product gathering, and other group events, authorization is through a permit process that can limit or deny activities within the conservation area.

In 2008, the resource management plans for BLM's Vermilion Cliffs National Monument and the Arizona Strip Field Office were completed. With the signing of the Records of Decision, the route designations for the monument were completed. The BLM is working to implement the

route designations for the Arizona Strip Field Office, including routes within the conservation area. The BLM will develop a comprehensive Trail and Travel Management Plan and EA for motorized/mechanized vehicle use and non-motorized use on routes. A Travel Management Plan is a comprehensive plan for future management of the route network for all public land access needs. Access needs are identified by the BLM, other agencies, permitted users (hunters, ranchers, mineral site users, commercial recreation users, etc.), local communities, and members of the public, and are evaluated in conjunction with the BLM's legal mandate to protect natural and cultural resources. The individual route evaluations have been included in the applicable Travel Management Plans.

Lands and Mining

Most of the NKRD is withdrawn from mineral entry under the Grand Canyon Game Preserve enabling legislation. Areas outside of the game preserve withdrawal include House Rock Valley and the eastern edge of the Kane Canyon area of the East Kaibab monocline. However, the entire House Rock Valley area has now also been withdrawn from mineral entry for 20 years as part of the Northern Arizona Mineral Withdrawal, which was approved by the Secretary of Interior in January 2012. A withdrawal from mineral entry excludes these areas from mining and exploration, subject to valid existing rights. There are no valid existing rights in the conservation area.

In 2013, Arizona Department of Transportation started the 89A Trail Canyon (Creek) Drainage Improvements project between mile post (MP) 572.35- MP 574.75 along their existing highway easement, approximately five miles east of Jacob Lake, Arizona. The project includes replacing culverts to improve flow conditions. The project should prevent excessive run-off, such as that experienced post-Warm Fire (see section below) and protect Paradine plains cactus downstream from the drainage. The project was completed in summer 2014. A post project walk-through with the engineers has been conducted; however effectiveness of the project will not be known until a significant rain event occurs.

Vegetation Treatments

Arizona Game and Fish Department Treatments

AGFD has proposed to do habitat improvement projects on the east side of the plateau; however, specific projects have not been identified, no NEPA analysis has been started, and these projects are not within the Forest Service's 5-year program of work.

Other Vegetation Treatments

The only vegetation treatments inside the conservation area in the last 11 years have been focused around Warm Fire rehabilitation. In August 2006, immediately after the fire, an aerial seeding of Quick Guard triticale was performed on 1,700 acres in and around Unit G. This same location was seeded again in March 2008 with a mix of triticale and two native grass species. The purpose of these two seed applications was to stabilize the soil and compete with cheatgrass. Seed applications for stabilization were performed on heritage resource sites and upper Trail

Canyon in 2007 and 2008. There was and have been mixed results on seeding to reduce cheatgrass. At this time, cheat grass has not become established in any great density within the conservation area. There are plans to conduct research to treat cheatgrass on the west side of the Kaibab plateau, related to the Kane Ranch Environmental Assessment/research partnership associated with the Grand Canyon Trust. Cheatgrass is well established in many areas on the west side. The studies are broad and include burning, timed grazing, various species seed mixtures, and application of herbicides. Results from these studies should help if cheatgrass on the east side becomes more established.

Forest Development Roads

After the Warm Fire, several roads inside the conservation area were damaged by post-fire flooding. For public safety concerns, FR 220 was closed from the junction with Highway 89A to the 284 junction. Repairs were performed to FR 220 and FR 224 in 2007 to reopen the road, staying inside the road corridor whenever possible. The road received minor repairs in 2008. Repairs consisted of replacing culverts and back-filling under the existing roadbed. These road closures and repairs likely avoided silting of plants such as occurred in the trail canyon area.

Although road widening, realignments, and passing lanes have not been proposed recently along State Highway 89A, any associated activity would require NEPA analysis, which would include alternatives and/or avoidance measures. Within the conservation area, non-emergency USFS road maintenance will be restricted to the existing footprint of the roadbed, so there should be no effects to Paradine plains cactus from road maintenance activities.

Soils and Watershed Management

Although there have been projects implemented to stabilize soils post-Warm Fire, as discussed above, there have been no other projects in Paradine plains cactus range specifically for soil or watershed management since the last assessment, and the USFS has not identified a need for any further stabilization or restoration work to improve watershed condition in the conservation area.

Wildlife Monitoring

AGFD and the Peregrine Fund have both stated that condor tracking occurs on existing roads and trails. Vehicular travel off-road is not permitted per existing travel management regulations for both BLM and the NKRD, except for authorized administrative and emergency purposes.

Fuel Wood Harvesting

Personal use fuelwood and Christmas tree harvesting are not authorized on NKRD lands inside the conservation area and within Vermilion Cliffs National Monument, which protects Paradine plains cactus from any potential effects of these activities. This policy is enforced by Law Enforcement Officers (both Forest Service and BLM) and other Forest Service employees.

Invasive Species

Invasive species were identified post-1997 as a concern and are continuing to be managed to avoid impacts to Paradine plains cactus. All noxious and invasive species treatments occur in accordance with the Coconino, Prescott, and Kaibab Final Environmental Impact Statement for Integrated Treatment of Noxious or Invasive Weeds. This document and related Best Management Practices discuss appropriate measures for treating undesirable species inside the conservation area (USDA 2005). Use of pesticides, herbicides, and biocontrol agents should minimize impacts on non-target flora and fauna.

There are numerous species from the Arizona State Noxious Species list that are known to occur near the conservation area and are being controlled and/or eradicated by mechanical and/or chemical options upon detection. However, there have been no noxious species noted inside the habitat boundary at this time. Plants are generally considered to be noxious if they are exotics (nonnative) and negatively impact agriculture, navigation, fish, wildlife, or public health. The highest current threat to the habitat is cheatgrass (*Bromus tectorum)*, a species that is not on the noxious plant list, but is considered to be highly invasive and is well suited to pinyon-juniper ecosystems that have experienced disturbance.

Cheatgrass was considered to be a concern following the 2006 Warm Fire in the conservation area. Surveys for cheatgrass began in the spring 2007. Three small infestations were found and chemical treatment began in the fall of 2007. Fall is considered to be the most effective timing for treatment of cheatgrass. The herbicide utilized was Plateau, containing the active ingredient Imazapic, which is the only chemical approved to be utilized in Paradine plains cactus habitat.

Surveys of the existing cheatgrass populations and for new populations are ongoing, with the assistance of Grand Canyon Trust and the AGFD. In all, over 12 cheatgrass populations have been receiving treatment and continue to be monitored inside the Paradine plains cactus habitat area. Most of these populations occur along FR 220. Herbicide application will be deferred from any site where a known Paradine plains cactus exists or is found, until it is known, through testing, that herbicides would not affect Paradine plains cactus. To date, monitoring indicates dramatic decreases in cheatgrass in all treatment locations. Locations that were treated and contained heavy frequencies of cheatgrass are now dominated by native grasses and forbs. Although cheatgrass has been in areas adjacent *to* Paradine plains cactus potential habitat, plants have not been found before, during or since any cheatgrass control. Surveys for all noxious and invasive species will continue.

Wildlife

It has been suggested that bison could impact Paradine plains cactus. However this is unlikely, since bison movement normally occurs south of the conservation area, in the vicinity of Saddle Mountain Wilderness. Current USFS direction is that bison should be managed within the House Rock Wildlife Area. Coordination is occurring between Northern Arizona University, USFS, AGFD, and Grand Canyon National Park with a proposal to remove bison from the park and return the bison to the House Rock Wildlife Area.

Plant Collection

The following plant protection measures have been developed and are included within Collection Permits:

- For populations of 100 individuals or less, herbarium specimen collections shall be limited to collection of diagnostic plant parts and not the removal of whole plants. Further documentation using photographs of the vouchered plant would be helpful to include with the specimens obtained.
- If populations of less than 25 individuals are encountered, no voucher specimens should be collected, nor manipulative studies conducted. The populations should be documented photographically, preferably digitally, and include information about locality, GPS coordinates, date, and photographer. Such documentation should also be submitted to designated herbaria in lieu of a voucher specimen.
- Equipment used to obtain plant parts and manipulate flowers should be cleaned between plant populations to avoid the transference of disease organisms.
- Seed collected should not exceed 10 percent of the available seed set for any population.
- Materials collected under this permit are for use in this study only, and may not be transferred elsewhere without the permitting agency's written permission at the USFS regional office of BLM state office level. Materials collected cannot be sold or exchanged as noted in permit conditions. Priority for any excess wild-collected seed, or seed produced in the study will be for secure gene/seed banking to meet future research and recovery needs.

Appendix D: PARADINE PLAINS CACTUS CCA WORKING GROUP (PEPAW) MEMBERS

U.S. Department of Agriculture,
Kaibab National Forest, Angela Gatto, Mike Hannemann, Chirre Keckler

U.S. Department of Interior
Bureau of Land Management, Jace Lambeth
Fish and Wildlife Service, Bill Austin, Julie Crawford

Appendix D: Monitoring Protocol

Conduct Trend, Conservation Area, and Implementation and Effectiveness monitoring, as described below. Monitoring protocols may be adjusted as needed during annual PEPAW review to ensure that best available science is being use and monitoring is meeting objectives.

In general, monitoring is most effective during the reproductive season. Monitoring should occur after winter snow melt, and weekly visits to populations are needed to determine the optimal time (typically after April 1) to conduct surveys.

1. Trend monitoring: Conduct Level 1 monitoring with permanent sample plots to gather biological and demographic data at each designated site annually. Results will be analyzed and presented in a report format which will be distributed to all signatories annually. Two plots are located at 4 different sites: House Rock Valley, Pasture Canyon, Valley, and Trail Canyon.

    - Plots are marked with a center rebar stake and are 10 meters in diameter. Pin flags are placed at every cactus in the plot and are read with a Total Station or similar accurate device. Diameter of plants, number of heads and number of buds/flowers are recorded. The accuracy of Trend monitoring will be used to track individual plants, plant health, age, and reproduction over time.

2. Conservation Area monitoring: This monitoring is designed to determine if the boundary of the conservation area is accurate. It will help to determine the numbers of plants across the conservation area and the distribution/connection of population within the conservation area. This monitoring will also include areas outside to the conservation area boundary. Results will be evaluated and changes in the conservation area boundary may be recommended.

    - Pin flags are placed at every cactus and are read with a standard GPS unit. This monitoring is not to record every plant but recording groups of plants and estimate number of individuals across the landscape. General health of population and overall habitat conditions will be recorded.

3. Implementation and Effectiveness monitoring: Implementation monitoring is used to determine if mitigation measures identified during the NEPA process are adequate. Effectiveness monitoring is used to determine if management practices as designed and executed are effective in meeting planned goals and objectives; "did the management practice do what we wanted it to do?"

4. Continue to use the monitoring protocol as a way to train Forest Service personnel and others to recognize Paradine plains cactus in its habitat, while developing an understanding of the biology, ecology, and monitoring techniques.

5. All monitoring results will be entered into the agency database of record on an annual basis.

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