Wright Fishhook Cactus
(Sclerocactus wrightiae L. Benson)

5-Year Review:
Summary and Evaluation

U.S. Fish and Wildlife Service
Utah Field Office – Ecological Services
2369 West Orton Circle, Suite 50
West Valley City, Utah 84119

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5-YEAR REVIEW
Wright fishhook cactus (*Sclerocactus wrightiae* L. Benson)

1.0 GENERAL INFORMATION

1.1 REVIEWERS

Lead Regional Office: Mountain-Prairie Regional Office
Bridget Fahey, Regional Endangered Species Chief, 303/236-4258
Seth Willey, Regional Recovery Coordinator, 303/236-4257

Lead Field Office: Utah Ecological Services Field Office
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1.2 METHODOLOGY USED TO COMPLETE THE REVIEW

The U.S. Fish and Wildlife Service (Service/USFWS) initiated a 5-year review of the *Sclerocactus wrightiae* (Wright fishhook cactus) on August 3, 2005 (70 FR 44544). This 5-year review was drafted by the species' lead botanist in the Utah Ecological Services Field Office (Utah ESFO). It summarizes and evaluates information provided in the recovery plan, current scientific research, and surveys related to the species. All pertinent literature and documents on file at the Utah ESFO were used for this review (see References section below for a complete list). Interviews with individuals familiar with Wright fishhook cactus were conducted as needed to clarify or obtain specific information.

1.3 BACKGROUND

1.3.1 Federal Register Notice Citation Announcing Initiation of This Review

70 FR 44544, August 3, 2005

1.3.2 Listing History

Original Listing
FR notice: 44 FR 58866, October 11, 1979
Date listed: October 11, 1979
Entity listed: Species: *Sclerocactus wrightiae* L. Benson (Wright fishhook cactus)
Classification: Endangered range-wide

1.3.3 Associated Rulemakings

None

1.3.4 Review History

Historic 5-year reviews for all listed species have been initiated by the Service's Washington, D.C., office (50 FR 29901, July 22, 1985; 56 FR 56882, November 6, 1991). The species' status also was considered in the 1985 Wright Fishhook Cactus Recovery Plan (USFWS 1985) and our 2005 90-day petition finding (70 FR 44544, August 3, 2005).

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

At the start of the 5-year review, the Recovery Priority Number for Wright fishhook cactus (*Sclerocactus wrightiae*) was 17. This ranking indicated: (1) the plant's taxonomic standing as a full species; (2) a perceived low degree of threat from activities such as exploration for mineral resources; off-road or off-highway vehicle (OHV) use; livestock grazing; collection of the cactus; predation by cactus borer-beetles (*Moneilema semipunctatum*); level of adequacy of regulatory mechanisms on Federal lands; and inadequate regulatory mechanisms on State and private lands; drought; and vulnerability to extinction due to low numbered populations; and (3) a relatively low potential for full recovery due to the presence of significant obstacles, in this case the fact that the threats extend throughout the range of the species and cannot be solved by a single solution.

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

1.3.6 Recovery Plan

Name of plan: The Wright Fishhook Cactus (*Sclerocactus wrightiae* Benson) Recovery Plan (hereafter referred to as the "Recovery Plan")

Date issued: December 24, 1985

2.0 REVIEW ANALYSIS

2.1 APPLICATION OF THE 1996 DISTINCT POPULATION SEGMENT POLICY

2.1.1 Is the Species Under Review a Vertebrate?

No, the species is a plant; therefore, the DPS policy is not applicable.

2.2 RECOVERY CRITERIA

2.2.1 Does the Species Have a Final, Approved Recovery Plan Containing Objective, Measurable Criteria?

No. Section 4(F)(1)(B)(ii) defines "objective, measurable criteria" as those that when met, would result in a determination that the species be removed from the Endangered Species Act (ESA). In order to determine whether or not a species is endangered or threatened, or has improved to the point of reclassification or delisting, the ESA requires an explicit analysis of the five listing/delisting factors. However, the 1985 Recovery Plan includes only demographic based recovery criteria with no consideration of threats. Because the Recovery Plan's demographic criteria failed to address the five listing factors, they do not meet the ESA's standard for objective, measurable criteria. While we recommend the Recovery Plan be revised (see section 4.0), it is still referenced below to the extent that it provides useful information on the species' conservation needs.

2.3 UPDATED INFORMATION AND CURRENT SPECIES STATUS

2.3.1 Biology and Habitat

2.3.1.1 New Information on the Species' Biology and Life History

The Recovery Plan indicated actions were necessary to understand soil requirements and effects of disturbance to cryptobiotic crust; pollination mechanisms; seedling and germination requirements; and effects of larval predators. Below we will discuss new information since the Recovery Plan and where future research is needed.

Prior to 1985, it was thought that the species occurred on a variety of soil formations (see USFWS 1985 for more details). Today it appears the limiting factor for Wright fishhook cactus is soil physiology (Neese 1987; Kass 1990). In the vast majority of instances where plants are located (Neese 1987; Kass 1990), three of the following four habitat conditions

prevail: 1) close proximity to fine textured, presumably saline and/or gypsiferous strata that have contributed both texturally and chemically to the soil; 2) close proximity to a sand-forming geologic stratum that contributes to the substrate; 3) fine- or medium-sized gravels, pebbles, or fossil oyster shells in (and particularly littering) the surface of the soil; and 4) level to gently sloping terrain.

The Recovery Plan noted that the cacti are rare or absent where cryptobiotic crusts have been destroyed or are undeveloped. While information on the function of cryptobiotic crust in sustaining healthy Wright fishhook cactus populations is directly unknown, a body of research on cryptobiotic soils exists (Belnap and Gardner 1993; Harper and Pendleton 1993) that could be used for management application.

Pollination mechanisms for this species, and in general, have been researched with the following results: the species is almost completely self-incompatible (Tepedino 2000); the number of flowering individuals in an area is vital for outcrossing and reproductive success (Steffan-Dewenter and Tscharntke 1999); and pollination is limited by the foraging distance of ground nesting bees, which is strongly correlated to body size (Greenleaf 2005). Species-specific research is still needed to determine the habitat and lifecycle needs of pollinators; the species and availability of pollinators which visit Wright fishhook cactus; and pollination success given density and distance between Wright fishhook cactus plants.

Since the Recovery Plan, no field research has been conducted to determine seedling and germination requirements in the wild. However, some information is available for greenhouse cacti. Experienced cacti growers have propagated Wright fishhook cactus since the mid-1970s. Mesa Gardens in New Mexico has been germinating Wright fishhook cactus by mimicking natural conditions since the mid-1980s (Steven Brack, Mesa Gardens, New Mexico, pers. comm., 2005). Because Wright fishhook cactus produce seeds with hard seed coats, the seed is sown in the winter to expose seeds to multiple cycles of freezing and thawing. A soil mix of loam and small rocks is used to mimic natural conditions. In this case, an estimated 30 - 50% of seeds germinated over a 5-year period, but longevity was difficult to maintain (Brack, pers. comm., 2005).

Transplanting wild Wright fishhook cactus has occurred with some short-term success. Early spring, prior to spring growth, is a favorable time for such transplantation. Plants transplanted into the wild have a documented 50 - 70% survivorship for their first year (E. Holt, JBR, pers. comm. USFWS, 2005; JBR Environmental Consultants, letters to Bureau of Land Management (BLM), Price Field Office (Price FO), October 1999 - November 2001). Long-term success of transplanted Wright fishhook cactus individuals is unknown as monitoring has not occurred.

The investigation of the effects of larval predators is limited to field observations within three monitoring plots in the northern portion of Wright fishhook cactus range (Wayne and Emery Counties). Kass (1990) documented a beetle from the Cerambycid family, later determined to be *Moneilema semipunctatum*, as a possible source of significant cacti mortality. At the time, 25 - 30% of the resident cacti population in his study plots died from the beetle infestation. Cacti infested by this beetle exhibited--chew marks; shrinkage between growth segments; and a spongy and yellow appearance (Kass 2001b). These beetle infestations caused lower vigor, decreased fecundity, and death of individual plants (Kass 2001b). The beetle appears to select for larger, reproductively mature cacti, which likely results in a decline of reproductive rates (Kass 2001b). Cactus-borer beetles are described less frequently as a main source of Wright fishhook cactus mortality (Clark and Groebner 2003; Clark et al. 2004; Clark and Clark 2007). Future research may focus on determining the extent of beetle infestation and their potential effects at the population level.

2.3.1.2 Abundance, Population Trends, Demographic Features, or Demographic Trends

Today's estimated range distribution for Wright fishhook cactus extends across an approximate 860,000 acres (ac) of Utah's western Emery County, southeastern Sevier County, central Wayne County, and a small strip within Garfield County (Clark, unpublished data, 2005). Population estimates range from 4,500 - 21,000 individuals. Actual occupied acreage and number of plants across the extent of its range is unknown. Surveys suggest the species predominately occurs in small, widely scattered pockets with most occupied sites totaling less than 50 individuals (Neese 1987; Kass 1990; Clark 2001, 2002a, 2002b; Intermountain Ecosystems 2002; Clark

and Groebner 2003; Clark et al. 2004; Utah Heritage Program database 2005; Clark 2006).

Long-term monitoring and field site surveys have occurred since the Recovery Plan and provide additional information on abundance and trends. This information is described below.

Long-term Monitoring Plots

Long-term monitoring plots for Wright fishhook cactus occur at four sites. One monitoring plot is located at Capitol Reef National Park and receives regular monitoring visits. Three monitoring plots on BLM lands (Price FO) receive less regular monitoring.

Capitol Reef National Park - Monitoring to determine cattle impacts has occurred in most years since 1987 at Capitol Reef National Park. Clark and Clark (2007) conclude the following:

- Individuals of Wright fishhook cactus declined in all size classes due to drought conditions that affected central Utah from 1999 - 2003. Increases in recruitment and survival rates have followed in years with above average precipitation.
- Areas of lower soil moisture, primarily upland areas, experienced higher mortality in drought years.
- Cacti density increased more rapidly within an area excluded from cattle grazing than a similar areas with livestock grazing.
- Larger size cacti growing away from substantial vegetation are susceptible to uprooting by cattle.
- More large-sized individuals grew without the protection of substantial vegetation when not impacted by cattle grazing.
- Numbers of flowers per individual inside the cattle exclosure were higher than those outside, suggesting that cacti populations without livestock impacts, such as trampling, have a higher reproductive potential.
- During periods of expansion, cacti within the exclosure increased by 200%, while those exposed to grazing increased by 50%.

BLM Lands – In 1993, three monitoring plots were established on BLM lands in Wayne and Emery Counties. One monitoring experience loss of all individuals by 1995 with no new recruitment was observed during the following 7 years (Intermountain Ecosystems 2003). The other two plots decreased in numbers by 74% during the same years (Intermountain Ecosystems 2003). In 2000, it was noted that sizable populations with adults larger than 9.0 centimeters (cm) (3.5 inches (in)) wide, those plants with the highest reproductive success, were no longer found within any of the three monitoring plots (Kass 2001a). Monitored sites have suffered a slow decline, with a mortality-to-recruitment ratio of approximately 2.5 to 1 (Kass 2001a; Intermountain Ecosystems 2003). Monitoring has not occurred in recent years.

Survey Revisits of Neese (1987)

From 1999 - 2003, the Interagency Plant Team (IPT) revisited 88 occurrences previously located in the spring of 1986 by Neese (1987). These locations were primarily on BLM land. More individuals were found at 25 sites (28%), the same number of individuals were present at 3 sites (3%), lower numbers were counted at 34 sites (39%), no cacti were found at 16 sites (18%), and 10 sites (11%) lacked previous data so no comparison could be made. Return surveys from 1999 - 2003 counted a total of 623 individual cacti. This total is similar to the 602 individual cacti recorded on the same sites in 1986. However, the decline or complete loss of individuals at 57% of sites is of concern. In addition, the 1999 - 2003 surveys located 5 new sites with 42 individuals (Clark and Groebner 2003).

Survey Revisits of Kass (1990)

In 2001, Intermountain Ecosystems (2002) returned to 20 sites previously identified in 1989 (Kass 1990). Of nine sites where plant numbers were originally recorded (Kass 1990), more individuals were present at zero sites (0%), the same number were counted at two sites (22%), lower numbers were documented at five sites (56%), and no individuals were present at two sites (22%). The total number of individual plants at these 20 sites decreased from 87 in 1989 to 50 in 2001 (Intermountain Ecosystems 2002).

In the 2004 field season, the IPT visited 18 sites previously documented in 1989 (Intermountain Ecosystems 2002; Kass 1990). More plants were counted at six sites (33%), a lower number were found at seven sites (39%), none were relocated at four sites (22%), and one site (6%) was determined to be *Sclerocactus whipplei*. During this period, plants had declined or disappeared at 61% of revisited sites. Total counts observed at these 18 sites in 1998 and 2001 were 420 individuals, while only 131 individuals were counted in 2004. While performing surveys, the IPT documented 4 new sites with 49 plants (Clark et al. 2004).

Compiling the above (Clark and Groebner 2003; Intermountain Ecosystems 2002; Clark et al. 2004), of the 104 sites with original data from Neese (1987) and Kass (1990), 36 sites (35%) were found with more or the same number of Wright fishhook cacti and 68 sites (65%) were relocated with less or no presence of the cacti. Twenty-two sites out of 104 (21%) had no Wright fishhook cacti present. The declines in the number of sites occupied and the number of individuals counted within these sites from 1,109 - 804 (~28% reduction) may be due to natural and/or man-made features.

Survey of Factory Butte

In 2006, surveyers counted 677 individuals on approximately 620 ac. Total counts for all areas around Factory Butte are unknown because only a portion of suitable habitat has been surveyed. Some sites were previously known; however, trend data for these locations is not available.

Other Reported Trend Data

Demographic trends show fewer observations of large individuals. Neese (1987) reported that 13 sites contained large class adult individuals (>9.0 cm (3.5 in) diameter). Revisits of the same sites (Clark and Clark 2007) between 2000 and 2004 found only 7 sites containing 12 individuals of this size class. Loss of large class individuals may be due to a variety of factors including illegal collection, beetle kill, and impacts from cattle. For example, the largest individual ever found was illegally taken from public lands in 1991 (BLM 1991). Kass (2001b) indicates 84% of beetle kill was in the adult class sizes (4.0 – 9.0 cm (1.6 to 3.5 in) and >9.0 cm (>3.5 in)), whereas beetles did not infest the smallest class (0 – 2.0 cm (0 – 0.8 in)). Clark and Clark (2007) note that cattle

lift up their feet just enough to clear the ground when walking; thus, larger cacti are more likely to be kicked. Over a 20-year timeframe, larger size class of cacti were more numerous within a livestock exclosure, while less frequently seen outside the fenced area (Clark and Clark 2007).

Intermountain Ecosystems (2003) documented a 74% loss of individuals in 2002 from the original 1993 numbers at established plots. The decline was primarily attributed to small ground mammal predation, cactus borer beetle infestations, and drought. Kass (2001b) concluded that 23% of the mortality documented from 1993 - 2000 was due to cactus borer beetles; it is unknown if this is an unnatural mortality rate or if the beetle is having population level effects long term.

During drought years (1999 - 2003), a 20 - 33% decrease in cacti numbers occurred at the Capitol Reef National Park study site (Clark and Clark 2007). While positive precipitation in 2004 and 2005 showed an increase in numbers, population numbers have not rebounded to pre-drought counts (Clark and Clark 2007).

The Wright's fishhook cacti reach their reproductive maturity slowly. Researchers observe that individual cactus begin flowering around 4 to 5 year of life, producing flowers generally less than 50 percent of the time (Kass 2001a; Clark and Clark 2007). The highest reproductive rates were for large adult plants (>9.0 cm (3.5 in) wide), which flowered between 75 and 100 percent of the time (Kass 2001a; Clark and Clark 2007). Clark and Clark (2007) indicate that on average it takes one year to grow 0.5 +/- 0.25 cm (0.2 +/- 0.1 inches). Therefore, the highest reproductive individuals are at least 18 years old. This slow rate to reproductive maturity thwarts quick recovery of sites damaged or lost to current threats (see 2.3.2.1).

2.3.1.3 Genetics, Genetic Variation, or Trends in Genetic Variation

No work has been done on the genetics of individuals or populations for Wright fishhook cactus.

2.3.1.4 Taxonomic Classification or Changes in Nomenclature

None.

2.3.1.5 Spatial Distribution, Trends in Spatial Distribution, or Historic Range

Our knowledge of the known range of this species has improved under the guidance of the Recovery Plan actions. We are now aware of additional occupied habitat in Wayne, Emery, Sevier, and Garfield Counties. Below is a chronological summary of suitable habitat inventories since completion of the Recovery Plan:

- In 1986, Neese Investigations (Neese 1987) completed a large scale inventory for Wright fishhook cactus and other associated sensitive species in eastern Sevier County, and Wayne and Garfield Counties east of Capitol Reef National Park. Survey revealed 180 site locations primarily on BLM land.

- In 1989, a habitat inventory of threatened, endangered and candidate plant species occurred within the San Rafael Swell of Emery County, Utah. This survey (Kass 1990) located 32 site occurrences primarily on BLM land.

- From 1999 to the present, the BLM Richfield Field Office (Richfield FO), Capitol Reef National Park, Dixie National Forest, and Fishlake National Forest developed an interagency agreement, pooling resources to fund an IPT. Cacti sites discovered by Neese (1987) and Kass (1990) were resurveyed under this agreement.

- Intermountain Ecosystems (2002) conducted revisits of sites discovered by Kass (1990).

- In 2006, surveys to document plants and assess OHV effects, were conducted on BLM lands in the Factory Butte area (Clark 2006).

2.3.1.6 Habitat or Ecosystem Conditions

Although we do not have quantified data regarding the extent of habitat fragmentation range-wide, regular land use impacts occur at many of the known sites. Of 88 occupied sites visited by the IPT from 1999 - 2003, no threats were observed or documented on 20 sites (Clark and Groebner 2003). Of the remaining 68 sites, OHV use was observed within or nearby 36 sites (53%), cattle use at 38 sites (56%), and 20 sites (29%) showed other disturbances such as human footprints, vehicle

pullouts, dirt bikes, horse or hiking trails, predation by ground squirrels or beetles, road grading, and group camping.

In 2004, the IPT collected data from 44 sites of which 38 were revisits to previously known locations (Clark et al. 2004). Individual cacti mortality was documented from cattle trampling at 6 sites, beetle or rodent predation at 11 sites, and crushing by OHV use at 4 sites. Mortality of unknown cause was documented at 23 sites. Of these same sites, cacti at 6 sites were rated in good condition, 25 sites as marginal, and 11 sites as poor.

Clark (2006) identified impacts from OHV use to cacti and concluded that "fragmentation due to OHV use around Factory Butte will result in increasingly smaller numbers of individual plants within each site location and will decrease the available habitat for maintaining or expanding populations. The smaller numbers and increased distance between plants will reduce the genetic viability of each site location and increase the chance that an entire site location may die out due to natural phenomena, such as drought and beetle predation, or man-caused factors, such as heavy cattle use in some locations."

Effects of cattle grazing have been documented at a monitoring site within Capitol Reef National Park. Over a 20-year period, data on changes in spatial distribution were collected within and outside of a livestock exclosure. Prior to constructing the fenced cattle exclosure, cacti densities were comparable in both plots. Post-fencing data showed reduced survival rates in nearly all unfenced plots. The only exception was for cacti that grew adjacent to substantial vegetation stands. In these cases, the adjacent vegetation provided some protection from cattle trampling (Clark and Clark 2007). A greater number of large class adults were documented in the fenced plot, and smaller class juveniles were able to survive further from substantial vegetation (Clark and Clark 2007).

Central Utah experienced a drought from 1999 - 2003 (Clark and Clark 2007). Survival and reproduction of Wright fishhook cactus were affected by the lack of precipitation across its range (Intermountain Ecosystems 2003; Clark and Clark 2007). Numbers of individuals at Capitol Reef National Park indicates a rebound due to years of higher precipitation, although pre-drought numbers have not been reached (Clark and Clark 2007). Additionally, areas with other impacts such

as livestock grazing or low moisture-retention ability are exhibiting slower population rebounds (Clark and Clark 2007).

2.3.2 Five-Factor Analysis

2.3.2.1 Present or Threatened Destruction, Modification or Curtailment of its Habitat or Range

Wright fishhook cactus was listed in 1979 as an endangered species based on small population numbers and limited distribution, and on known and potential threats from factors including potential exploration and development of mineral resources and OHV use (44 FR 58866, October 11, 1979).

Within the San Rafael Resource Area, coal, oil, gas, gypsum, bentonite, uranimium, vanadium, sand, gravel, building stone, and bentonite clay have been actively pursued by commercial and industrial development in past years. Approximately 29% of the known range (approximately 101,000 of 350,000 ha (250,000 of 860,000 ac) for Wright fishhook cactus is underlain by coal deposits and roughly 12% (approximately 41,000 of 350,000 ha (102,000 of 860,000 ac)) is leased for oil and gas extraction (USFWS, Utah ESFO, unpublished data). Surface coal mining in known and potential habitat of Wright fishhook cactus (7,202 ac) was recently analyzed (Preliminary Draft Coal Unsuitability Analysis for Henry 2005 and USFWS, Utah ESFO, unpublished data, 2005). Mostly due to known Wright fishhook cactus occupation, roughly 20% (1,424 ac) was deemed unsuitable for development (Internal Draft Coal Unsuitability Analysis for the Henry Mountains 2005). In this case, the species' listed status protected the species habitat from potential development. However, ongoing energy and mineral development remains a potential threat across the species' range.

Livestock trampling was not identified as a threat in the 1979 listing; however, recent data has caused us to rethink this conclusion. Ninety-five percent of the species range occurs within grazing allotments (USFWS, Utah ESFO, unpublished data). Kass (1990) observed the following conditions about livestock: (1) where lifestock is limited, Wright fishhook cactus is more abundant, (2) cattle easily uproot the shallow-rooted cacti, and (3) cacti often grow inside the protection of shrubbery in overgrazed areas. Cattle use was documented within or near roughly half of sites surveyed by the IPT in 2002 and 2003 (Clark and Groebner 2003). In 2003 and 2004, cattle

trampling was one of the top three documented sources of mortality at occupied sites (Clark and Groebner 2003; Clark et al. 2004).

Monitoring to determine cattle impacts has occurred intermittently since 1986 at Capitol Reef National Park. This information is summarized above in sections 2.3.1.2 and 2.3.1.6. Grazed plots had lower survival rates and lower reproductive potential due to the loss of the larger size class of cacti. Clark (2006) reported 32% of the dead cacti encountered during surveys at Factory Butte were killed by cattle stepping on them or kicking them out of the ground. Overall, documented mortality associated with trampling and uprooting suggest livestock presence can be a threat.

Bison may have an impact to the cactus in the central part of Capitol Reef. Due to hunting pressures in the Henry Mountains, the bison relocate to the park and congregate in areas that contain Wright fishhook cacti. While the effects of bison are not well documented, trampling and uprooting of some cacti may result (T. Clark, pers. comm., 2005).

The 1979 listing of Wright fishhook cactus identified OHV use for mineral exploration as a threat to individual plants and detrimental to suitable habitat (44 FR 58866, October 11, 1979). Today OHV use is a popular recreation, unseen to this extent in 1979. Part of Wright fishhook cactus' known range occurs within the San Rafael Swell, a popular destination for OHV use. Clark and Groebner (2003) documented OHV use at or nearby 50% of Wright fishhook cactus locations revisited on BLM lands. Clark (2006) indicated that one-half of the populations located within the emergency restricted area at Factory Butte (discussed below in Factor D) had at least some damage resulting from OHV use. OHV use remains a threat across the species' range. However, Federal land management agencies can restrict or designate use areas on Federal lands in order to manage and minimize this threat.

2.3.2.2 Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Listing of the Wright fishhook cactus was predicated, in part, on the occurrence of field collection of the species for commercial and hobby purposes. The listing stated that collectors could quickly reduce known populations if protective measures were not instituted (44 FR 58866,

October 11, 1979). This concern was so significant that we determined that it was not prudent to designate critical habitat (44 FR 58868, October 11, 1979). Specifically, we determined publication of critical habitat maps detailing population locations would make them even more vulnerable to illegal taking.

Illegal collecting still occurs. Adult plants at three sites in the Factory Butte area were excavated about 10 - 15 years ago (Kass, pers. comm. 2004); these sites still lack vigorous adult plants. Another population of 20 individuals was taken in 1991, including the largest Wright fishhook cactus ever found, which measured over 12 inches in height (BLM 1991). Wright fishhook cacti sites are infrequently monitored. Thus, the extent of illegal collection is unknown. However, Kass (2001b) indicates declines in larger individuals have occurred since 1986 and suggests that some of these declines are the result of illegal amateur and commercial collecting.

2.3.2.3 Disease or Predation

Disease and predation were not considered factors affecting the species in the 1979 listing decision (44 FR 58866, October 11, 1979). Kass (1990) first documented a beetle from the Cerambycid family as possibly being a significant source of mortality for Wright fishhook cacti. At that time, it was common to find 25 - 30% of the resident population dead from infestation (Kass 1990). Twenty-three percent of mortality from 1993 - 2000 in monitoring plots was attributed to cactus-borer beetle with the highest mortality recorded in the adult reproductive classes (Kass 2001b). It is unclear if the cactus-beetle has an unnatural population-level effect to the species.

Other cacti predation identified by Kass (2001a and 2001b) included small ground mammals such as the Ord's kangaroo rat (*Dipodomys ordii*) and white-tailed antelope ground squirrels (*Ammospermophilus leucurus*). It is unclear if ground mammal predation is a population-level threat.

2.3.2.4 Inadequacy of Existing Regulatory Mechanisms

Wright fishhook cactus is listed as an Appendix I species under the Convention on International Trade in Endangered Species. Appendix I includes species that may be threatened with extinction and which are or may be affected by international

trade. International trade in wild specimens of these species is subject to strict regulation and is normally only permitted in exceptional circumstances. Trade in artificially propagated or captive-bred specimens is allowed, subject to license. The ESA regulates interstate commercial activities. However, small growers may supply local markets as interstate and international shipping is not involved. In these cases, it is difficult to determine if any part or product (seeds for example) have been removed, dug up, or derived from a wild plant in areas under Federal jurisdiction in violation of the ESA.

The ESA section 9 makes it unlawful to import or export; deliver, receive, carry, transport, or ship in interstate or foreign commerce in the course of a commercial activity; sell or offer for sale in interstate or foreign commerce; take (includes harm, harass, pursue, hunt, shoot, wound, kill, trap, capture, or collect any wildlife within the United States); take on the high seas; possess, ship, deliver, carry, transport, sell, or receive unlawfully taken wildlife; remove and reduce to possession any plant from areas under Federal jurisdiction; maliciously damage or destroy an endangered plant on areas under Federal jurisdiction; and remove, cut, dig up, or damage or destroy any endangered plant in knowing violation of any State law or regulation or in the course of a violation of a State criminal trespass law. These prohibitions apply equally to live or dead plants, their progeny (seeds in the case of plants), and parts or products derived from them.

Wright fishhook cactus occurs on lands administered by Capitol Reef National Park; BLM; the State of Utah, including Goblin Valley State Park; and private lands. Existing regulatory mechanisms are greatly aided by the protections afforded under the ESA. For example, grazing at Capitol Reef National Park is authorized under the enabling park legislation. About 75% of the range of Wright fishhook cactus within the National Park has livestock grazing. Without listing under the ESA, livestock impacts would go unregulated.

On BLM lands, existing BLM Land Use Plans provide some general habitat protection mechanisms; however, they do not include any specific-species protection for threatened or endangered plants such as the Wright fishhook cactus. Updated Resource Management Plans (RMPs) for BLM lands may incorporate new protective mechanisms, such as oil and gas notices and OHV trail designations, but these have not yet been finalized and still may not fully address species' needs.

No laws in the State of Utah afford protection to this species on State or private lands. There is extremely limited information pertaining to other Utah State lands or private land management for protection of Wright fishhook cactus. One known example is from Goblin Valley State Park. In 1998, the park completed an interim report on species of special concern, which included Wright fishhook cactus (Franklin 1998). Management recommendations included avoiding Wright fishhook cactus in future projects and channeling foot traffic around the overlook parking area to reduce impacts to the species and its habitat. Since 1998, a campground was reconstructed within its previous site and some road improvements were made within the park; however, no actions were taken to improve foot traffic impacts (E. Swalberg, pers. comm., 2005). Changes at the campground are not believed to have directly affected Wright fishhook cactus (Swalberg, pers. comm., 2005), but no data is available to verify this conclusion as the State park is not required to conduct botanical studies or monitor long-term impacts.

Many section 7 consultations have occurred since the listing of Wright fishhook cactus (1979) and the Recovery Plan (1985).

Some examples of the species' need for regulatory protection are outlined here. The BLM Richfield FO was petitioned by the Southern Utah Wilderness Alliance, Friends of Factory Butte, and others to initiate an immediate emergency closure to OHVs within the Wayne County Factory Butte area. The closure was petitioned based on the documentation of considerable adverse effects to the cacti in 2006 (Clark 2006). A survey conducted by Deborah Clark (2006) showed that roughly 50% of the populations located within the emergency restriction area had at least some damage resulting from OHV use.

The BLM Richfield FO implemented an emergency travel restriction order for the area surrounding Factory Butte in 2006. The emergency closure does not apply to State or private lands. This emergency restriction also evoked other regulations on OHV use and adverse landscape effects, such as Executive Order Numbers 11644 and 11989 (37 FR 2877, February 9, 1972; 42 FR 26959, May 24, 1977), 43 CFR §§8341, 8342, and 8364.1. The emergency order restricted OHV travel to designated routes on 57,475 ha (142,023 ac). An OHV closure in the area consisting of

1,555 ha (3,843 ac) also is in effect. Approximately 1,053 ha (2,602 ac) remain open to OHV use, including the popular "Swing Arm City." This restriction is in effect until conditions giving rise to the restriction have been sufficiently addressed or until the Richfield FO RMP, currently under preparation, is finalized and implemented. Parties representing Wayne County, Garfield County, and others filed a complaint (Wayne County et al. vs. Cornell M. Christensen, manager of the Richfield Field Office of the BLM et al.; Case 2:07-cv-00138-DB, 03/08/2007) against this action. The case was dismissed on procedural grounds.

It is believed that implementation of the restriction will likely reduce OHV damage to those populations by restricting use to existing roads and trails and avoiding known cacti populations. The potential exists that some OHV use may be displaced onto Wright fishhook cactus habitat surrounding the restricted area. However, BLM asserts that the overall affect will be one that benefits the cactus and its habitat (C. Christensen, BLM Richfield FO, corr., to Field Office Supervisor, USFWS, Utah ESFO 2008).

The emergency restriction may be revised in the future based in part on the monitoring of resource conditions and trends in the area. The Draft Richfield FO RMP completed a public comment period in January 2008. A final Record of Decision and section 7 consultation is still pending. Habitat management for the Wright fishhook cactus, including OHV use in the Factory Butte Area, will be considered for the Final Richfield FO RMP. Special interest groups such as the Utah Shared Access Alliance provided comments that Factory Butte should be designated a Special Recreation Management Area largely open to cross country travel with only a few exceptions. Without the protections of the ESA, protections for the cacti would likely be minimal.

The recent emergency OHV closure at Factory Butte indicates that regulatory protection can be fully implemented by Federal agencies when necessary (discussion above). However, some Wright fishhook cactus habitat warrants better land management which may not occur without ESA consultation.

Few land management designations protect Wright fishhook cactus. In Capitol Reef National Park, it is estimated that a third of Wright fishhook cactus habitat is within recommended wilderness. Although these lands were recommended by the

National Park Service as wilderness in 1974, Congress has yet to officially designate them and give them full protection under the Wilderness Act. The enabling legislation for Capitol Reef National Park requires that they allow cattle grazing. About 75% of the range of Wright fishhook cactus within the Park is managed for livestock grazing (Tom Clark, Chief of Resource Management and Science, Capitol Reef National Park, pers. comm. 2005). As discussed previously, cattle trampling can be detrimental to the cacti.

Additionally, the BLM Price and Richfield FOs each manage two Areas of Critical Environmental Concern (ACEC), which may contain Wright fishhook cactus habitat. ACECs can be changed at any point through the RMP revision process.

The Price FO manages the Muddy Creek ACEC (9,122 ha/22,540 ac) and the I-70 Scenic Corridor ACEC (21,104 ha/52,150 ac). The Muddy Creek ACEC contains Wright fishhook cactus habitat, but no populations have been documented within the ACEC boundaries. The nearest documented occurrence is a quarter mile outside the ACEC boundary. The I-70 Scenic Corridor ACEC contains 10 documented cacti locations, including the Mesa Butte study population. Although the ACECs do not contain specific stipulations for Wright fishhook cactus, OHV use is restricted to designated roads and trails; and land treatments, such as chainings, prescribed burns, mechanical vegetation manipulation, reseedings, and rangeland restoration are excluded. Grazing and recreation activities are allowed within the ACECs.

The Richfield FO manages the North Caineville Mesa (1,556 ha/3,846 ac) and the South Caineville Mesa (2,163 ha/5,346 ac) ACECs. Both of these were established for relic vegetation, which would include Wright fishhook cactus. No occupied cacti sites are known to occur in the South Caineville Mesa ACEC. The North Caineville Mesa ACEC has historic records indicating species presence.

Existing regulatory mechanisms, secured through the ESA, have reduced some of threats on Federal lands. In the absence of the ESA's protective regulatory mechanisms, we believe the situation would be considerably worse.

2.3.2.5 Other Natural or Manmade Factors Affecting its Continued Existence

The original listing decision cited the restricted known localities and low population numbers as a factor affecting the species. Low numbers could result in high vulnerability to any number of otherwise harmless disturbances (44 FR 58866, October 11, 1979). While more populations have since been found, Kass (2001a) indicates that the species is narrowly distributed and exhibits slow declines as evidenced by its high mortality to recruitment rate. Additionally pollination is limited by foraging distance of ground nesting bees (Greenleaf 2005). As the species is almost completely self incompatible (Tepedino, pers. comm. Bolander 1994; Tepedino 2000), the number of flowering individuals in an area reachable by pollinators is vital for outcrossing and reproductive success (Steffan-Dewenter and Tscharntke 1999).

Climate change could potentially impact the species. According to the Intergovernmental Panel on Climate Change (IPCC) (2007), "Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level." Average Northern Hemisphere temperatures during the second half of the 20th century were very likely higher than during any other 50-year period in the last 500 years and likely the highest in at least the past 1,300 years (IPCC 2007). It is very likely that over the past 50 years cold days, cold nights, and frosts have become less frequent over most land areas, and hot days and hot nights have become more frequent (IPCC 2007). It is likely that heat waves have become more frequent over most land areas, and the frequency of heavy precipitation events has increased over most areas (IPCC 2007).

Changes in the global climate system during the 21st century are very likely to be larger than those observed during the 20th century (IPCC 2007). For the next two decades, a warming of about 0.2°C (0.4°F) per decade is projected (IPCC 2007). Afterward, temperature projections increasingly depend on specific emission scenarios (IPCC 2007). Various emissions scenarios suggest that by the end of the 21st century, average global temperatures are expected to increase 0.6 - 4.0°C (1.1 - 7.2°F) with the greatest warming expected over land (IPCC 2007). It is very likely that hot extremes, heat waves, and heavy precipitation will increase in frequency (IPCC 2007).

Localized projections suggest the southwest may experience the greatest temperature increase of any area in the lower 48 States (IPCC 2007). There also is high confidence that many semi-arid areas like the western United States will suffer a decrease in water resources due to climate change (IPCC 2007). Milly et al. (2005) project a 10 - 30% decrease in precipitation in mid-latitude western North America by the year 2050 based on an ensemble of 12 climate models.

Drought conditions have led to a noticeable effect on vigor of both large and small size classes and may exacerbate effects of other factors such as predation and livestock impacts (Kass 2001b; Kass, pers. comm., 2004; Clark and Clark 2007). Prior to anthropogenic threats, Wright's fishhook cactus is likely to have experienced and rebounded from periods of drought. However, should substantial climate changes materialize, such as those related to increased temperature and reduced precipitation, these changes are likely to reduce the long-term survivorship of individual Wright's fishhook cacti.

2.4 SYNTHESIS

Since the development of the Recovery Plan, we have obtained a better understanding of the species distribution and trends. Survey data indicate greater threats in terms of predation by cactus borer beetles, livestock trampling and uprooting of plants, and OHV use. Cumulatively, these threats and 4 consecutive years of drought (1999 - 2003), have reduced numbers of the species. A commitment to surveys, site revisits, and regular monitoring of land-use impacts is needed to increase our understanding of the species' status and management needs. The recent closure of the Factory Butte area was important for the immediate reduction of adverse impacts to the Wright fishhook cactus. Long-term planning for OHV use in areas of sensitive habitat will be necessary to balance between species' protection and recreation. The frequently reported loss of the larger, most reproductive, adult-size classes is of concern for the species resiliency to impacts and ability to recruit new individuals. The Wright fishhook cactus retains the classification of a species which is in danger of extinction throughout all or a significant portion of its range.

3.0 RESULTS

3.1 RECOMMENDED CLASSIFICATION

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist
_X_ No change is needed

3.2 NEW RECOVERY PRIORITY NUMBER: 11

Brief Rationale: Wright fishhook cactus is a full species. Known threats had been categorized as low in the past. However, our review indicates that the threats are more numerous than at the time of the listing and are more immediate. Monitoring indicates greater effects to Wright fishhook populations due to man-made impacts such as livestock grazing and OHV use, in combination with natural impacts such as drought and predation. Reversing these threats may be difficult due to current land-use practices and the slow rate at which the species reaches its reproductive peak. Therefore, we assess known threats as moderate and the potential for recovery low, giving Wright fishhook cactus a new recovery priority number of 11 (see table in section 1.3.5).

3.3 LISTING AND RECLASSIFICATION PRIORITY NUMBER

N/A

4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

We recommend revising the recovery plan to reflect the best scientific and commercial information available. The revised recovery plan should include objective, measurable criteria which, when met, will result in a determination that the species be removed from the Federal List of Endangered and Threatened Plants. Recovery criteria should address all threats meaningfully impacting the species. The recovery plan should also estimate the time required and the cost to carry out those measures needed to achieve the goal for recovery and delisting.

The recovery plan should include updated range and population numbers. Routine surveys, site revisits, and regular monitoring are needed, with an emphasis on quantifying impacts such as cattle grazing, OHV use, and beetle larvae infestation. The recovery plan should provide recognition for new and/or increased threats since the time of listing, such as livestock grazing, off-road, beetle predation, and drought.

In the mean time, we recommend the following actions for Federal agencies:

- In areas of Wright fishhook cactus habitat, acquire in holdings of State lands for consistency in land management practices, species conservation, and regulatory mechanisms.

- Complete surveys, site revisits, and regular monitoring and quantify of impacts such as cattle grazing, OHV use, and beetle larvae infestation. All known sites should be revisited regularly.

- Increase educational programs to facilitate appreciation of and respect for sensitive areas which may contain habitat or occupancy of threatened or endangered plant species.

- Support Wright fishhook recovery by providing personnel and fiscal resources yearly to implement recovery actions.

- Develop a recovery team to update the Recovery Plan and to annually prioritize, assess, and fulfill recovery actions.

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of Wright fishhook cactus (*Sclerocactus wrightiae*)

Current Classification: Endangered range-wide

Recommendation resulting from the 5-Year Review:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist
__X__ No change needed

Review Conducted By: Heather Barnes, Botanist, Utah Ecological Services Field Office

FIELD OFFICE APPROVAL:

Lead Field Supervisor, U.S. Fish and Wildlife Service

Approve: _____ Date: 7/18/08
Field Supervisor, Utah Ecological Services Office

REGIONAL OFFICE APPROVAL:

Lead Regional Director, U.S. Fish and Wildlife Service

Approve: _____ Date: 8-25-08
Regional Director, Region 6