

MESA VERDE CACTUS

(Sclerocactus mesae-verdae)

RECOVERY PLAN



U.S. FISH & WILDLIFE SERVICE

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1984

RECOVERY PLAN FOR THE MESA VERDE CACTUS

SCLEROCACTUS MESAE-VERDAE

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For

U.S. Fish and Wildlife Service, Region 2

APPROVED: _____


Regional Director, Region 2
U.S. Fish and Wildlife Service

DATE: _____

3/30/84

SUMMARY

- Goal:** To remove the Mesa Verde cactus from the Federal list of endangered and threatened species by securing the five presently known populations from present and future human threats and by ensuring that the Mesa Verde cacti are maintained as vigorous, self-sustaining populations throughout their natural habitat.
- Recovery Criteria:** Criteria for delisting of the Mesa Verde cactus are based on attempted protection of the five known populations plus the establishment of two restricted use areas for selected portions of Mesa Verde cactus habitat on the Navajo Indian Reservation and on BLM administered land. An additional criteria is the provision of 10,000 plants per year into the commercial pipeline for 5 years.
- Actions Needed:** Major steps needed to meet the recovery criteria include: monitoring, management, and protection of the known populations; establishment of at least two restricted use areas; survey of all potential habitat; development of a commercial artificial propagation program and research on the distribution, population biology and ecology.

DISCLAIMER

This is the completed Mesa Verde Cactus Recovery Plan. It has been approved by the U.S. Fish and Wildlife Service. It does not necessarily represent official positions or approvals of cooperating agencies and it does not necessarily represent the views of all individuals who played a key role in preparing this plan. This plan is subject to modification as dictated by new findings and changes in species status and completion of tasks described in the plan. Goals and objectives will be attained and funds expended contingent upon appropriations, priorities, and other budgetary constraints.

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PART I

INTRODUCTION

The Mesa Verde cactus, Sclerocactus mesae-verdae (Boissevain ex Hill & Salisbury) L. Benson, was listed as threatened on October 30, 1979 (44 FR 62471). Two other members of this genus are recognized as threatened or endangered, Sclerocactus glaucus (K. Schum.) L. Benson and S. wrightiae L. Benson, respectively. In addition, the 1980 Notice of Review and its 1983 supplement list three candidate species from this genus: S. whipplei (Engelm. & Bigelow) Britton & Rose var. heilii Castetter, Pierce and Schwerin, S. polyancistrus (Engelm. & Bigelow) Britton & Rose, S. spinosior (Engelm.) Woodruff & Benson. Sclerocactus mesae-verdae is known from only a few isolated populations in the Navajoan Desert of northwestern New Mexico and southwestern Colorado. Population numbers are declining due to collection and habitat destruction from a variety of human uses. This recovery plan outlines a course of action which, if implemented, will result in the protection and expansion of populations and habitat of S. mesae-verdae to a point at which the survival of the species is assured. Once this point is achieved Sclerocactus mesae-verdae can be removed from threatened status.

Taxonomy

Sclerocactus mesae-verdae was first discovered at its type locality near Cortez, Colorado by Charles H. Boissevain and published as Coloradoa

mesae-verdae (Boissevain and Davidson, 1940). Many cactus collectors and dealers still refer to this cactus as "Coloradoa". The type specimen was deposited at the Dudley Herbarium of Stanford University, but Lyman Benson (1966) was not successful in locating the specimen in 1965. Lyman Benson (1951) placed the Mesa Verde cactus in the genus Echinocactus and later, in 1966, transferred it to the genus Sclerocactus. Del Weniger (1970) believes this cactus belongs in the genus Echinocactus, on the grounds that he does not recognize the genus Sclerocactus. Jerry Arp placed this species in the genus Pediocactus (Arp, 1972).

Lyman Benson (1982) feels the Mesa Verde cactus is related to the genus Pediocactus, especially P. bradyi in its spines and flowers, but the fruit dehisces in the typical Sclerocactus manner.

S. mesae-verdae is closely related to Sclerocactus wrightiae. Both are gypsophiles occupying similar niches and are separated by approximately 140 miles (see Table 1). Benson (1966) writes that S. wrightiae is the connecting link between S. mesae-verdae and S. whipplei.

Morphology

The Mesa Verde cactus stems are usually singular (but may form clusters of up to 15), globose, 3.2-6.5 cm tall (1 1/2 - 3 inches) and of equal diameter; central spine 0 (possibly 1-4); radial spines 8-11, 6-13 mm long (1/4 - 1/2 inches), white, tan, straw or gray; flowers 2 cm in diameter (3/4 inch), cream to yellow; fruit green, becoming brown with age and splitting open horizontally; seeds black.

Sclerocactus mesae-verdae and S. wrightiae have several morphological features in common: stem size, shape and color; flower shape and color; fruit dehiscence (not bearing scale leaves); and the ability to retract into the soil during periods of drought. Table 1 compares the major differences of the two species.

Table 1

Morphological features of S. mesae-verdae and S. wrightiae

	<u>S. mesae-verdae</u>	<u>S. wrightiae</u>
Central spines	0 or rarely 1	4-6 (Lower one hooked)
Radial spines	8-11	5-10
Flowers:		
A. Color	Cream to yellow	Cream to pink
B. Fragrance	Not fragrant	Fragrant
Seeds:		
A. Color	Brownish-black	Black
	2.5 - 3 mm long	2 mm long
B. Size	2.2 mm wide	3.5 mm wide

Distribution

The Mesa Verde cactus occurs at the eastern edge of the Navajoan Desert in Montezuma County, Colorado, and San Juan County, New Mexico. A questionable population cited from Montrose County, Colorado is probably based on misidentification of juvenile Sclerocactus glaucus. S. mesae-verdae occurs within a rectangular edaphic strip that extends from an area fifteen miles north of the Colorado-New Mexico border, east to near

Waterflow, New Mexico, approximately fifteen miles to the west and ten miles south of Shiprock, New Mexico. One isolated population is located one mile south of Sheep Springs, New Mexico (Map 1).

In all, five major populations are known, one in the southwestern corner of Colorado and four in northwestern New Mexico. The Colorado population is on the Ute Mountain Indian Reservation. Three of the New Mexico populations occur on the Navajo Indian Reservation, and one population is found east of the Hogback and north of Waterflow, New Mexico, on Bureau of Land Management administered lands, Public Service Company of New Mexico lands, and other private lands.

Colorado

Montezuma County: Base of the Mesa Verde Escarpment, Ute Mountain Indian Reservation.

New Mexico

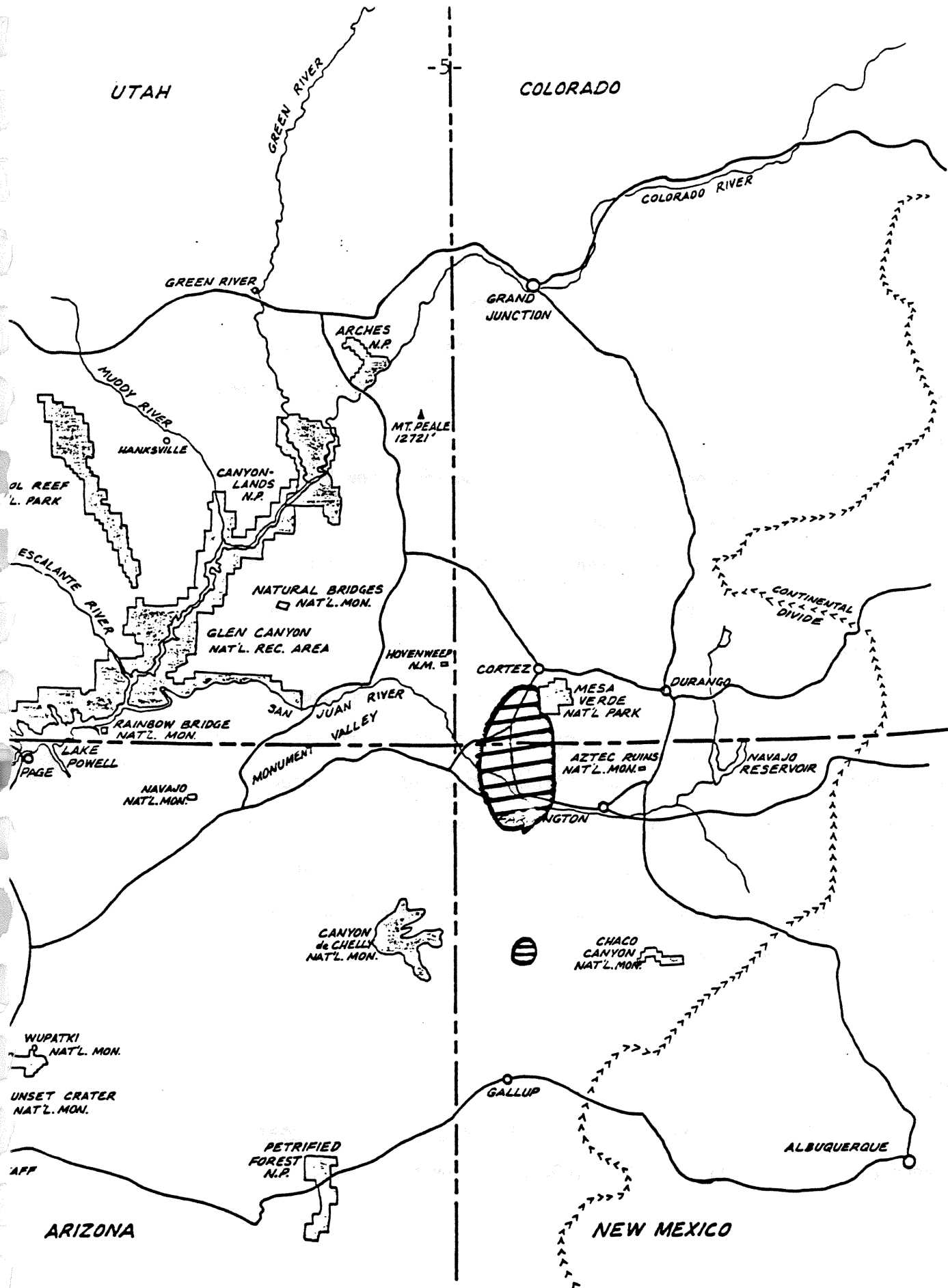
San Juan County: Near the Colorado-New Mexico state line, Navajo Indian Reservation (NIR); Shiprock area, NIR; north of Waterflow, BLM and private lands; Sheep Springs area, NIR.

Habitat

Sclerocactus mesae-verdae grows on the Colorado Plateau in the floristic province of the Navajoan Desert (Smith, 1970). The bulk of the species of two genera of cacti, Sclerocactus and Pediocactus are known only from the Navajoan Desert. The Mesa Verde cactus is at the eastern edge of the Navajoan Desert, east of the Chuska, Carrizo and Ute Mountains.

UTAH

COLORADO



In general the Mesa Verde cactus is restricted to the Mancos and Fruitland Shale Formations. These clay formations erode easily, forming low rolling hills ("badlands") with sparse vegetation. The Mancos and Fruitland Formations have high alkalinity, are gypsiferous, and have shrink-swell properties that make them harsh sites for plant growth. Nonetheless, these formations provide favorable habitat for a number of endemic species, including Sclerocactus mesae-verdae.

The population of Mesa Verde cactus at Sheep Springs, New Mexico, appears to grow in the Menefee Formation on the tops of hills and mesa slopes. Actually, the roots are anchored in the Mancos Shale Formation while the base of the plant rests on the Menefee Formation which comprises a very thin surface layer.

The Mesa Verde cactus is most frequently found growing on the tops of hills or benches, slopes of hills, and very rarely on level ground between the hills or benches. The exact geologic strata occupied by the species, and its edaphic requirements are poorly known and need to be determined in order to provide clues to factors restricting its distribution. This cactus grows at 1,600-2,000 meters elevation in areas where annual precipitation varies from 8-20 cm.

Population biology

A. Demography

1. Population numbers: The total population of Sclerocactus mesae-verdae is approximately 5,000-10,000 plants over its total known

range. The Montezuma County, Colorado population numbers approximately 1,000 plants. Estimates for the other four population centers in New Mexico have varied from 4,000-10,000 plants.

2. General demographic details:

(a) Area of the populations:

Colorado population 62.4² km

New Mexico populations

1. Waterflow 10.2² km

2. Shiprock 184.3² km

3. New Mexico-Colorado state line 107.5² km

4. Sheep Springs 1.2² km

Total area = 364.6² km

- (b) Density: The number of individuals of S. mesae-verdae per unit area varies tremendously. As many as 20 individual plants have been seen within 50 square meters or as few as a single specimen with no other Mesa Verde cacti within several hundred meters. This cactus does not have an even distribution throughout its range but tends to form major populations within certain favorable habitats.
- (c) Presence of dispersed seeds: The fruit matures and splits in mid-June with the seeds falling to the base of the plant. Seeds were found at all mature plants visited that were healthy and flowering (see Phenology, page 9).

- (d) Evidence of reproduction: Seedlings were observed at all populations. Often seeds will germinate adjacent to the parent plant. Given the large number of seeds produced per plant and the actual number of seedlings observed, it is apparent that the success rate for these seedlings is very low. This is probably due to various aspects of the physical environment such as the depth the seed is buried, the duration of moisture around the seed, the packing of soil, the temperature, etc.
- (e) Evidence of population expansion or decline: In the natural sense the Mesa Verde cactus populations appear to be stable; however, we need to know the dynamics of the situation--what is the turnover rate for the Mesa Verde cactus? As mentioned earlier this cactus tends to cluster, forming small to large populations. If an old parent plant is dying, e.g. due to an insect burrower, then often there are several seedlings found to replace the parent plant.

The amount of collecting of Sclerocactus mesae-verdae has been great and widespread in the past but its overall effects on native populations are unknown. One to three monitoring stations should be set up at each of the five populations and checked at least twice a year to determine, at least approximately, how much collecting is being done. Evidence indicates

that collecting is occurring because very few large plants are found. Since establishment of new plants, even from a large seed bank, is rare, collectors can be expected to have a very strong impact on the population.

- (f) Age of plants before reproduction: Most S. mesae-verdae begin to bloom after 3-4 years of age. One plant was observed that appeared to be only 2 years old with one flower.

B. Phenology

1. Budding Time: Early to mid-April.
2. Flowering Time: Late April to early May; the flowers open in mid-afternoon and close in late afternoon. An individual flower lasts two to three days.
3. Fruit Formation: Late May to early June; the percent of adults that set forth fruit after flowering is unknown but is high--probably 80-90 percent.
4. Fruit Dehiscence: Mid to late June. The fruit dehisces by forming a circular and nearly horizontal but irregular line near the base.
5. Seeds: The seeds fall to the base of the plant. Running water seems to be a major factor in carrying the seeds away from the parent plants where they then fall into cracks in the dry adobe soil. Saltation is probably also an important factor, particularly in hilltop individuals. A dry period might be required for the anchoring of the seeds in the cracks of the soil, especially in areas where associated vegetation is sparse (Knight, 1981). More study needs to be done to determine if birds and/or rodents play

a role in the dispersal of Mesa Verde cactus seeds. With the wide distribution of the Mesa Verde cactus, it would seem logical that animals might help in the dispersal of the seeds.

Dormancy and other environmental requirements for seed germination in their natural habitat is unknown. Bill Taylor, of Albuquerque, has had some success at germinating Sclerocactus mesae-verdae seeds. In 1978 Taylor planted 50 Mesa Verde seeds--30 stratified and 20 not stratified. Taylor had 70 percent germination success rate with the stratified seeds and only 10 percent germination for non-stratified seeds. Steve Brack of Belen, New Mexico, has also had better success with stratification of seeds. Taylor and Brack both agree that two criteria are needed for a high success rate at germinating S. mesae-verdae seeds--must age 2-4 years and undergo alternate freezing and thawing periods.

On the average, each S. mesae-verdae produces 200 seeds, approximately 20-30 seeds per fruit. A population of fifty healthy plants would thus potentially produce approximately 10,000 seeds annually. Probably less than 1 percent of these seeds would germinate, as determined by the number of seedlings actually observed in the field. It is likely then, that under field conditions the germination rate of this cactus is very low and the seedling mortality rate is unknown.

C. Associated Species

1. Plants: The Mancos and Fruitland Clay Formations support a meager

vegetation. The dominants include Atriplex corrugata and A. nuttallii. Other plants include: Sclerocactus whipplei var. intermedius, Opuntia polyacantha, Chrysothamnus Greenei, Sporobolus cryptandrus, Hilaria jamesii, Sphaeralcea coccinea, Abronia elliptica, Phacelia splendens, P. corrugata, Oenothera caespitosa var. navajoensis, Cleome lutea, Tetradymia spinosa, and Streptanthella longirostris.

2. Insect Vectors: The major pollinator of Sclerocactus mesae-verdae is believed to be a metallic green sweat bee belonging to the family Halictidae (Knight, 1981). No other pollinators have been observed.

Land Ownership

At least 70 percent of the entire population of the Mesa Verde cactus lies within the Navajo Nation and another 20 percent within the Ute Mountain Indian Reservation. Any successful recovery effort will require the participation and cooperation of both these tribes. Both the Ute and the Navajo Reservations are Federal lands under the administration of the Bureau of Indian Affairs (BIA). North of Waterflow, New Mexico, S. mesae-verdae grows mostly on small blocks of Bureau of Land Management land but is also growing on Public Service Company of New Mexico (PNM) land, and a small amount on other privately owned land. PNM is aware of this cactus and is cooperating in its protection. Any construction through BLM or BIA land that is potential habitat for the Mesa Verde cactus must have prior approval from BLM or BIA, and possibly informal and formal consultation by the U.S. Fish and Wildlife Service.

Impacts and Threats

The present and historic range of the Mesa Verde cactus are the same except for the newly discovered location at Sheep Springs, New Mexico--a disjunctive extension of its range by 36 miles.

Threats are principally of two types: Direct collection of individuals by commercial or private collectors, and destruction or modification of its habitat. Populations have been significantly reduced by cactus collecting (P. Pierce pers. comm., 1978). S. mesae-verdae habitat is being destroyed, severely impacted, or is potentially in danger. The following is a list of existing or potential threats.

1. Coal mining and related activities.
2. Oil and gas exploration and production.
3. Commercial and residential expansion.
4. Off-road vehicle (ORV) impact.
5. Commercial and private collectors.
6. Livestock trampling and utilization.
7. Highway or road building and maintenance.
8. Construction of new power- and pipelines.
9. Pesticide use.
10. Natural threats.
 - A. Burrowing insect larvae.
 - B. Frost heaving.
 - C. Erosion.
 - D. Interspecific competition.

E. Restriction to narrow edaphic situation, and limited habitat availability.

1. Coal Mining and Related Activities

Though currently no coal mining is being actively pursued in the present habitat of known populations of Sclerocactus mesae-verdae, there is much activity nearby. Consolidation Coal is operating a strip mine at Burnham, New Mexico, approximately 20 miles from known S. mesae-verdae populations. The Navajo Mine, south of Waterflow, is continuously strip-mining in a southward direction from its present location. Its current mining operations are 2 miles south of known Mesa Verde cactus populations. Sun Belt Coal, a subsidiary of Public Service Company of New Mexico, is strip-mining 1/2 mile east of the Waterflow Mesa Verde cactus population. The Waterflow population is the only one known to be growing on the coal-bearing Fruitland Formation and coal is known to underlie an area of this population. No Mesa Verde cactus have been found in the Bisti region, where coal leasing activity is occurring.

The San Juan Basin Action Plan (BLM) lists the impacts of developing 26 Preference Right Lease Applications (PRLA) for the development of coal. This plan lists alternatives ranging from the leasing of 129 million tons of coal from 8 tracts to leasing 1.94 billion tons of coal from 39 tracts (BLM, Nov. 1982). The PRLA's and Target Level Alternative state that no habitat for federally threatened or endangered species has been identified in the biological assessment prepared for Section 7 consultation.

The Environmental Impact Statement (EIS) on Public Service Company of

New Mexico's (PNM) proposed New Mexico Generating Station (NMGS) and Possible New Town lists possible effects on potential habitat of the Mesa Verde cactus in areas traversed by 2 proposed transmission lines--T4 and T5--and by 3 alternative water pipelines--P1, P2, and P3.

T4 An alternative route for a 500 kv transmission system from NMGS to Rio Puerco Station.

T5 A 5 mile 500 kv loop leading west of NMGS and corridorized with the new route of N.M. 371.

P1 A 42 inch water pipeline running 40 miles from an intake along the San Juan River near Farmington and south to a reservoir approximately 2 miles south of NMGS. 75% of this route would follow along the old and new N.M. 371.

P2 A water pipeline which would run 43 miles from an intake along the San Juan River near Bloomfield and south-southwest to a reservoir approximately 2 miles south of NMGS.

P3 This 49 mile alternative would also start near Bloomfield and follow the southern route, but part of this route is east of N.M. 44.

At the NMGS powerplant site no threatened or endangered species would be impacted because the species of concern do not occur in any areas that would be disturbed by construction activities (BLM, 1982a).

Potential acid precipitation, as a result of the local power plant emissions, is a possible future threat to the Mesa Verde cactus.

At present there are no coal leases on the Navajo Reservation due

north or south of Shiprock, New Mexico. A large potential coal reserve lies south of Shiprock and occurs in potential Mesa Verde cactus habitat. There are no plans for coal development in the near future on the Ute Mountain Indian Reservation.

The planned Star Lake Railroad, designed to move coal, will start east of Thoreau, New Mexico and run north to Gallo Wash. In the future it may extend west to Bisti, north to Farmington and west to Shiprock. As of now the Star Lake Railroad will only go as far north as Gallo Wash (J. Analla, pers. comm., 1983). The railroad, as now planned, is not expected to enter any known Mesa Verde cactus habitat.

Consolidation Coal Company has proposed the construction and operation of the Navajo Railroad to transport coal from its Burnham, New Mexico mine to powerplants in the southwestern United States. This railroad would haul 9.7 million tons of coal from the Burnham Mine annually. The southern route will run to Gallup, New Mexico and is not expected to impact any known populations of the Mesa Verde cactus. The northern route is planned for the future and will only develop if contracts are worked out for the coal. This spur would run for approximately 10 miles north from Burnham and east of the Chaco River. The railroad would then cross the Chaco River and follow west of The Hogback. The railroad would cross the San Juan River and run parallel east of The Hogback and then east to the San Juan Generating Station. A population of Mesa Verde cactus was found along the route (T.22N., R.16W.) by employees of the firm Envirosphere. The population is 550 feet east of the rail centerline. No other populations were found along the proposed route.

2. Oil and Gas Exploration and Production

The rate of oil and gas development has increased substantially in the Four Corners region in the past several years. There are already many gas and oil wells located throughout the range of S. mesae-verdae and new ones are expected to be drilled. The Bureau of Land Management, Farmington Resource Area Headquarters, as a part of its right-of-way permit procedures, requires onsite examination of locations where oil and gas development might cause an impact on the Mesa Verde cactus. The BIA office in Window Rock, Arizona, requires an onsite examination by a qualified cactus expert for the Mesa Verde cactus before any development occurs in potential Mesa Verde cactus habitat. The Ute Mountain Indian Tribe has no prescribed procedures for protecting the Mesa Verde cactus.

One oil field site located 7 miles southwest of Shiprock, New Mexico is known as the Rattlesnake Field. This is an older well location and many wells are not active. There is the possibility of reopening some of these wells with the use of new pressure techniques and deeper drilling. This renewed activity may have some impact on S. mesae-verdae populations. The potential for future oil and gas drilling on S. mesae-verdae habitat is high throughout the Ute Mountain Indian Reservation.

In the very near future a 16 inch gas line will be laid parallel to U.S. Highway 666 between Shiprock and Gallup, New Mexico. From Shiprock south to Table Mesa and in the region in and near Sheep Springs the pipeline passes through Mesa Verde cactus habitat.

3. Commercial and Residential Expansion

Shiprock, New Mexico currently has plans for housing development and commercial expansion in the near future. The Mesa Verde cactus has been observed near houses and businesses in and near Shiprock. Given the present emphasis on energy and mineral exploration and exploitation--coal, oil, gas, and/or uranium development is almost certain to occur near and on the Navajo Reservation. Along with this push for energy, the human population of Shiprock is expected to increase, and this will have an effect on commercial and residential expansion in the area. There is also the strong possibility of increasing the human population density of rural areas, especially along established roads.

A high priority of the Navajo Tribe is to upgrade and develop the Four Corners Monument. Though no Mesa Verde cacti have been found at this location, they have been found within 16 miles southeast of the Monument. If new construction occurs in the area around the Monument there should be a survey for the Mesa Verde cactus.

The Ute Mountain Indian Tribe is planning extensive agricultural development west of Ute Mountain within the near future. The Mesa Verde cactus has been found within 18 miles of this future development site. This land should be surveyed for the Mesa Verde cactus before clearing of land occurs.

4. Off-Road Vehicle (ORV) Impact

One of the greatest existing threats to Sclerocactus mesae-verdae is the use of ORVs--motorcycles and four-wheel drive units--in the habitat.

This use has increased dramatically in recent years and two populations of this cactus are presently experiencing high impacts from ORVs: the population southeast of Shiprock, New Mexico, and the population north of Waterflow, New Mexico. The closer the cactus is to human population centers, the larger the disturbance. Many of the Mesa Verde cacti tend to grow on the tops of hills where ORV use is heavy and soil disturbance is extensive. If a cactus is run over by an ORV or any other vehicle, the growing tip of the plant is often damaged and the cactus usually fails to flower and produce fruit and seed. In several cases individual plants have been observed that have been run over and uprooted by ORV activity. The ORV use can have a large impact on existing populations of cacti and continued use can lead to further erosion and gullying.

5. Collecting

It is difficult to determine the extent of the impact collecting has had on S. mesae-verdae and how much collecting is still continuing. Paul Knight of the New Mexico Natural Heritage Program discovered a population of approximately 75 Mesa Verde cacti north of Waterflow, New Mexico in 1981. During the blooming season of 1982 (late April) Knight could not relocate a single plant. Apparently, these cacti were collected sometime between Knight's visits, probably by a commercial dealer. During 1983, Dr. Richard Spellenberg of New Mexico State University, revisited a site where previously he had found many plants. On the latest visit the plants were rare and there were many holes in the clay. Very few Mesa Verde cactus populations have old plants--a sign that collecting is occurring.

Some seed collecting of the Mesa Verde cactus is also occurring. In the spring of 1982 a small population of Mesa Verde cacti were discovered 1 mile south of the population discovered by Knight. In late summer it was discovered that a seed collector had placed wool with a rubber band over each cactus that had fruit. The wool was used to catch the seeds when the fruit dehisces.

The Mesa Verde cactus is difficult to grow in cultivation, especially in areas of high humidity, for it rots very easily. As many as 90 percent of the plants collected may rot and die within the first year. Most collectors prize the cactus, and for those who specialize in rare cacti, the Mesa Verde cactus is a "must" for their collection. Some collecting is being done by European and Asian tourists and other visitors from foreign lands who are often in possession of exact locations of where this cactus grows. One character in its favor is that the Mesa Verde cactus blends with the Mancos and Fruitland clay soils and even when collecting sites are known, those who have not seen this cactus in its natural habitat have a difficult time finding it, except during the flowering season. Commercial dealers and private collectors can have a strong impact on the Mesa Verde cactus by over-collecting. The harvest of even a few plants from a single population several times a year could slowly deplete the population and reduce its reproductive potential and growth.

6. Livestock Trampling and Utilization

Domestic livestock grazing has been observed to cause some damage to Sclerocactus mesae-verdae through trampling. At present this is not a major impact, but as the Navajo livestock population increases, the fencing of land to enclose livestock will also increase. As a result of fencing,

high densities, and short duration grazing, trampling of cacti will occur more frequently. Use of high intensity, short duration grazing systems will have the maximum impact on this cactus. It has also been observed that some livestock eat the tops off of some plants.

7. Road Building and Maintenance

Many of the roads traversing known populations of S. mesae-verdae are narrow and unimproved. The building of new roads and the improvement of existing ones may directly impact some populations. Some new road construction will occur if the northern route of the Navajo Railroad is built, thus increasing chances of damage or destruction of cacti and habitat.

Route N 36, south of Shiprock, New Mexico, will be improved and paved from U.S. 666 to State 371 south of Farmington. This new highway will pass through Mesa Verde cactus habitat in the area south of Shiprock. Mesa Verde cacti have been found within the right-of-way along BIA Route N 36 and damage has already occurred to some of these plants during the preconstruction survey of the right-of-way.

8. Construction of New Power Lines

Two coal-fired power plants are located on or near existing Mesa Verde cactus populations. The San Juan Generating Station was built on Sclerocactus mesae-verdae habitat, and is located northeast of Waterflow, New Mexico. The Four Corners Power Plant is located south of Waterflow and east of Mesa Verde cactus sites. Powerlines have already been built through most of the New Mexico populations. When the NMGS is constructed, new powerlines will not go in the direction of Mesa Verde cacti populations.

A potential future problem for the Mesa Verde cactus is the building

of new electric distribution lines through its habitat. As the population of the Navajo Indian Reservation grows, many isolated settlements want and need electric power. This development could have a direct impact on the Mesa Verde cactus if such construction occurs through its habitat.

9. Pesticide Use

At present only one pollinator is known for Sclerocactus mesae-verdae, a sweat bee of the family Halictidae. Use of pesticides in the agriculture of the Farmington area constitutes a threat to all bees, which are highly susceptible to pesticides, and could possibly threaten pollination of the Mesa Verde cactus.

10. Natural Threats

- (A) Insect Larvae: A burrowing insect larve attacks some Mesa Verde cacti. Plants infected by this larva become discolored inside, rot, and usually die.
- (B) Frost Heaving: A few plants have been found that were apparently uprooted by frost heaving.
- (C) Erosion: Some Mesa Verde cacti growing on the side of hills have been uprooted and destroyed by gullyng and erosion, which increases with ORV use, livestock grazing, and other human uses.
- (D) Vegetative Competition: Few native plants grow in the highly gypsiferous soils of the Mancos and Fruitland Formations, and no introduced species seem to be invading the habitat, thus, competition is not likely to affect S. mesae-verdae.
- (E) Restriction to Narrow Edaphic Situation: In general, the species is restricted to the Mancos and Fruitland Formations; therefore, the habitat availability is limited.

PART II

RECOVERY

The primary objective of this recovery plan is to restore the Mesa Verde cactus to non-threatened status by:

- 1.) Securing the five known populations from present and future human threats.
- 2.) Ensuring that the Mesa Verde cacti are maintained as vigorous and self-sustaining populations throughout their natural habitat.

As this objective is met, delisting will be initiated when the following criteria have been met:

- 1.) Establishment of at least two restricted use areas for selected portions of Mesa Verde cactus habitat on the Navajo Indian Reservation and on BLM administered land.
- 2.) Provision of Mesa Verde cactus stock to trade outlets to help relieve the black market demand through the addition of 10,000 plants per year into the commercial pipeline for 5 years.

These goals are to be evaluated for adequacy upon attainment and prior to delisting.

Step-down Outline

1. Remove threats to Sclerocactus mesae-verdae by enforcement of existing regulations and management for protection.
11. Enforce existing regulations.

- 111. BLM and BIA responsibilities under ESA
- 112. Enforce existing trade regulations under ESA, CITES, and the Lacey Act.
- 12. Manage coal mining and related activities.
 - 121. Survey all potential habitat, particularly on the Fruitland Formation, for Mesa Verde cactus populations, and to determine actual and potential impacts.
 - 1211. Survey Federal lands and lands where federally authorized, conducted or funded activities are occurring to determine needs for ESA Section 7 consultation.
 - 122. Monitor the status of the planned Star Lake Railroad beyond the Gallo Wash.
 - 123. Monitor the status of the Navajo Railroad north of Burnham, New Mexico.
- 13. Monitor oil and gas exploration.
 - 131. Before drilling, pipeline installation or other related activities, use onsite examination for Sclerocactus mesae-verdae in habitats where this cactus is known to grow.
 - 132. Minimize the impact of oil and gas exploration and drilling by use of alternative techniques such as slant drilling, etc
- 14. Plan carefully for commercial, residential and agricultural expansion.

141. Survey for the Mesa Verde cactus before housing and commercial development in the Shiprock, New Mexico area.
 142. Survey for the Mesa Verde cactus in the Four Corners Monument region before development.
 143. Survey for the Mesa Verde cactus where the Ute Mountain Indian Tribe is planning new and extensive agricultural operations.
15. Determine the extent and degree of impacts of collecting on the Sclerocactus mesae-verdae.
 151. Develop a monitoring system to determine the number of individuals at each site and quantify the loss of individuals as a direct result of collecting.
 152. Develop a study to determine the extent and number of S. mesae-verdae actually in commercial trade.
 16. Exercise careful planning of new roads through S. mesae-verdae habitat.
 17. Monitor the status of new powerline construction.
 171. Survey for Mesa Verde cactus before new powerlines are planned or built through potential habitat.
 172. Include Mesa Verde cactus location information in planning for powerline routing.
 18. Obtain cooperative agreements with private land owners and with the Navajo and Ute Mountain Tribes to secure protection for

populations of Mesa Verde cactus on privately owned and tribal lands.

181. Designate selected portions of the known existing Mesa Verde cactus habitat on Navajo Indian Reservation lands as restricted use areas.

182. Regulate ORV use in all known Mesa Verde cactus habitat on the Navajo Indian Reservation.

1821. Establish ORV closure sites with signs, southeast of Shiprock, New Mexico.

1822. Establish alternate ORV use areas outside actual and potential habitat of the Mesa Verde cactus.

1823. Monitor closure sites periodically.

183. Develop a cooperative agreement with the Ute Mountain Indian Tribe.

184. Develop a cooperative agreement with private landowners for the protection and management of S. mesae-verdae population.

19. Develop and implement management plans for all Mesa Verde cactus populations on Federal lands.

20. Designate selected portions of the known existing Mesa Verde cactus habitat on BLM lands as an Area of Critical Environmental Concern.

2. Sustain healthy populations in their natural habitat at all existing sites.

21. Study the distribution, population biology and ecology of the Mesa Verde cactus.
 211. Survey for new populations in Arizona, Utah, and between Sheep Springs and Shiprock, New Mexico in areas of potential habitat; map the exact boundaries for all known sites and indicate extent of potential habitat.
 212. Determine all mechanisms involved in seed dispersal.
 213. Determine the number of years involved in seed germination and dormancy requirements.
 214. Determine what microhabitat factors are involved in seedling establishment and ecology.
 215. Determine the germination percentage rate of seeds and the taxon's overall reproductive potential and actual reproductive success.
 216. Determine what insects and/or other invertebrates are involved in the pollination/predation of Sclerocactus mesae-verdae.
 217. Identify the insect larva that attacks the Mesa Verde cactus.
3. Develop a program for commercial artificial propagation.
 31. Develop improved propagation techniques.
 32. Provide stock to outlets for commercial use.
 33. Develop a program for salvage of individual Mesa Verde cactus that are unavoidably threatened with destruction.

4. Develop public awareness, appreciation, and support for the preservation of the Mesa Verde cactus.
 41. Increase the public's knowledge of the Mesa Verde cactus and its problems, with pamphlets, talk programs, and slide shows.
 42. Enlist the support of public interest groups, particularly the Navajo and Ute Mountain Indian Tribes, for the protection and survival of the Mesa Verde cactus.

Narrative

The objective of this recovery plan is to remove the present and future human threats to the Mesa Verde cactus and its habitat. The actions just outlined should accomplish this goal, through fulfillment of the criteria established for reclassification of the Mesa Verde cactus. However, delisting of the species should not be viewed as the end of the recovery effort for the Mesa Verde cactus. After delisting is accomplished, the populations should continue to be monitored to ensure that the species does not once again decline, and opportunities to further enhance and expand the Mesa Verde cactus should be sought.

1. Remove threats to Sclerocactus mesae-verdae by enforcement of existing regulations and management for protection.

Because of the rarity of the Mesa Verde cactus all populations must be protected by the enforcement of existing international, Federal and state regulations including management of the threats to the species.

11. Enforce existing regulations.

111. BLM and BIA responsibilities under ESA.

All existing regulations must be adhered to by BLM and BIA in regards to listed species under ESA.

112. Enforce existing trade regulations under ESA, CITES, and the Lacey Act.

Any individual violating regulations established under ESA, CITES or the Lacey Act in regarding the Mesa Verde cactus

should be charged and convicted as a deterrent to others, and the judgment should be published in the Cactus and Succulent Journal of America.

12. Manage coal mining and related activities.

Much of the Fruitland Formation is underlain with seams of coal. Because this same Formation is also habitat for the Mesa-Verde cactus, conflicts between coal development and survival of the cactus can be expected.

121. Survey all potential habitat, particularly on the Fruitland Formation, for Mesa Verde cactus, and to determine actual and potential impacts.

A high amount of development, mostly pertaining to coal, is occurring in the Bisti, New Mexico region. Before construction and development occurs in outcrops of the Fruitland Formation not surveyed for the Mesa Verde cactus, a check for this plant should occur.

1211. Survey Federal lands and lands where federally authorized, conducted or funded activities are occurring, to determine needs for ESA Section 7 consultation.

The only population of Mesa Verde cactus not growing on Navajo or Ute Mountain Indian Reservations grows on the Fruitland Formation north of Waterflow, New

Mexico. This population lies atop known coal deposits and any coal related activities would require consultation with the Fish and Wildlife Service under Section 7 of the ESA.

122. Monitor the status of the planned Star Lake Railroad beyond the Gallo Wash.

Though there are no immediate plans for extending the Star Lake Railroad beyond Gallo Wash, there is talk of running a line to Farmington or possibly as far west as Shiprock, New Mexico. Extension of the railroad beyond Gallo Wash may occur in the distant future, and if so, there should be a survey for the Mesa Verde cactus along the proposed right-of-way.

123. Monitor the status of the Navajo Railroad north of Burnham, New Mexico.

The northern section of the Navajo Railroad will be built only if there is a contract for the coal with the San Juan Generating Station. At present no agreement has been worked out. If this northern section is finalized, a thorough survey for the Mesa Verde cactus along the proposed right-of-way should be conducted during the flowering season.

13. Monitor oil and gas exploration.

Although oil and gas exploration presently is not a major threat to the Mesa Verde cactus, careful monitoring should be conducted.

131. Before drilling, pipeline installation or other related activities use onsite examination for Sclerocactus mesae-verdae in habitats where this cactus is known to grow.

Before a site on the Fruitland or Mancos Formations is cleared for drilling, pipeline installation or other related activities, a survey for S. mesae-verdae should be conducted. If a potential oil and gas site is located within a major population of Mesa Verde cacti, drilling should not be allowed. Pipelines should be routed around Mesa Verde cactus populations.

132. Minimize the impact of oil and gas exploration and drilling by use of alternative techniques such as slant drilling, etc.

By means of careful planning and monitoring, and use of alternative techniques developed to allow drilling without disturbance of the surface immediately above the site, it may be possible to allow oil exploration and development on some sites of Mesa Verde cactus populations.

14. Plan carefully for commercial, residential and agricultural expansion.

Shiprock, New Mexico is near the largest known population of S. mesae-verdae. Whenever possible, commercial and residential expansion should be conducted away from this population. Any

agricultural expansion on Mancos clay soils should be surveyed for the Mesa Verde cactus.

141. Survey for the Mesa Verde cactus before housing and commercial development in the Shiprock, New Mexico area.

Planned for the near future are new housing development and a new shopping center. Shiprock will continue to grow in the future and whenever possible development should be planned away from known populations of the Mesa Verde cactus.

142. Survey for the Mesa Verde cactus in the Four Corners Monument region before development.

One of the Navajo Tribe's high priorities is the upgrading of the Four Corners National Monument. Many tourists visit this historical landmark annually. Though no Mesa Verde cacti have been found at the Four Corners Monument, it should be surveyed for the cactus before new development is allowed; the Four Corners Monument is in close proximity to known populations of this cactus.

143. Survey for the Mesa Verde cactus where the Ute Mountain Indian Tribe is planning new and extensive agricultural operations.

Extensive agricultural development is being planned by the Ute Mountain Indian Tribe for the west side of Ute Mountain.

Water will be furnished by the Dolores River Project.

Before the clearing of land a survey for the Mesa Verde cactus should be conducted.

15. Determine the extent and degree of impacts of collecting on the *Sclerocactus mesae-verdae*.

The amount of collecting being done needs to be determined and collecting curtailed.

151. Develop a monitoring system to determine the number of individuals at each site and to quantify the loss of individuals as a direct result of collecting.

A statistically accurate sample of plots should be established. All Mesa Verde cacti in each plot should be mapped, measured and recorded. Each plot should be checked twice a year, once during the blooming season and once after fruit has set.

152. Develop a study to determine the extent and number of *S. mesae-verdae* actually in commercial trade.

This study would probably be part of a national study concerning all cacti in the trade. The study would involve the monitoring of journals and nursery catalogs, interviews with dealers and undercover work.

16. Exercise careful planning of new roads through *Sclerocactus mesae-verdae* habitat.

As Shiprock, New Mexico expands the building of new roads and the

improvement of old ones may have an impact on some of the Mesa Verde cacti. The right-of-way of N 36 will be surveyed for the Mesa Verde cactus prior to improvement, and if populations are found the proposed route may have to be altered.

17. Monitor the status of new powerline construction.

As the population of the Navajo Indian Reservation grows, there will be more need for electric power. This new development may have a direct impact on the Mesa Verde cactus.

171. Survey for Mesa Verde cactus before new powerlines are planned or built through potential habitat.

Before the planning and construction of new powerlines through Mancos and Fruitland Formations, a survey for the Mesa Verde cactus should be conducted.

172. Include Mesa Verde cactus location information in planning for powerline routing.

If location information on the cactus is included in the early stages of powerline planning then most potential conflict should be avoidable.

18. Develop cooperative agreements with private land owners and with the Navajo and Ute Mountain Tribes to secure protection for populations of Mesa Verde cactus on privately owned and tribal lands.

To protect populations of Mesa Verde cactus on privately owned and Indian lands it will be necessary to obtain the goodwill of

the landowners and to negotiate some form of cooperative agreement with them. These agreements should provide for access for monitoring and for basic protection for the cactus.

181. Designate selected portions of the known existing Mesa Verde cactus habitat on Navajo Indian Reservation lands as restricted use areas.

Selected areas of the NIR Mesa Verde cactus habitat should be designated as areas of restricted use with a primary purpose of protection and enhancement of native plant species, including Sclerocactus mesae-verdae. The areas should be closed to ORV use, withdrawn from mineral entry, have only restricted grazing use, and have restrictions on road, powerline, residential, recreational and other developments.

182. Regulate ORV use in all known Mesa Verde cactus habitat on the Navajo Indian Reservation.

1821. Establish ORV closure sites with signs, southeast of Shiprock, New Mexico.

The Mesa Verde cactus population southeast of Shiprock, New Mexico on the Navajo Reservation is the largest known population. Being within 2 miles of Shiprock, this population is crisscrossed by denuded strips created by ORV use. This population needs to be closed to ORV use for the same reasons as elaborated in (15).

1822. Establish alternate ORV use areas outside actual and potential habitat of the Mesa Verde cactus.

Consideration should be given to replacing the closed areas with alternate sites in non-sensitive areas to give the ORV user another outlet. Suitable sites exist north of Shiprock and around the Farmington, New Mexico area. If the ORV activity can be diverted to other areas, then the Mesa Verde cactus habitat can be protected and restored.

1823. Monitor closure sites periodically.

Newly established ORV closure sites must be closely monitored by personnel from the pertinent agency, in order to prevent illegal use and to establish the public's awareness of the new regulations.

183. Develop a cooperative agreement with the Ute Mountain Indian Tribe.

A cooperative agreement for the management of the Mesa Verde cactus habitat on the Ute Mountain Indian Reservation should be prepared in order to coordinate agency efforts and to establish objectives for future work.

184. Develop a cooperative agreement with private landowners for the protection and management of *S. mesae-verdae*.

To provide for the maintenance of the Mesa Verde cactus populations on privately owned lands, it will be necessary

to obtain the cooperation and good will of the private landowners. Cooperative management agreements should be negotiated to acquire protection for the Mesa Verde cactus and its habitat.

19. Develop and implement management plans for all Mesa Verde cactus populations on Federal lands.

To facilitate co-operation between the agencies involved and to establish goals and objectives for the protection of the Mesa Verde cactus, management plans should be prepared for all populations on Federal lands. Once prepared, these plans should be implemented.

20. Designate selected portions of the known existing Mesa Verde cactus habitat on BLM lands as an Area of Critical Environmental Concern.

Selected areas of the BLM Mesa Verde cactus habitat should be designated as an ACEC, which should include at least the following restrictions: closure to ORV use, withdrawal from mineral entry, restricted grazing, and restricted right-of-way use. This designation is of particular importance to the maintenance and recovery of the species.

2. Sustain healthy populations in their natural habitat at all existing sites.

Due to the rarity of the Mesa Verde cactus, all existing populations must be sustained in a healthy and vigorous state. An in-depth

knowledge of the cactus' population biology and ecology is needed to understand its habitat requirements. The knowledge gained can be used to help sustain and manage healthy natural populations.

21. Study the distribution, population biology and ecology of the Mesa Verde cactus.

Generalized studies would provide information on what particular areas need more detailed studies. Growth requirements and limiting factors especially need to be studied in detail.

211. Survey for new populations in Arizona, Utah, and between Sheep Springs and Shiprock, New Mexico in areas of potential habitat; map the exact boundaries for all known sites and indicate extent of potential habitat.

Potential habitat for the Mesa Verde cactus exists near the Four Corners region in Arizona and Utah. These areas need to be surveyed for the Mesa Verde cactus.

Approximately 36 miles separate the Sheep Springs population from the southeastern Shiprock population. The habitat adjacent to the highway between the two populations does not seem to be typical habitat for this species. According to a geologic map of New Mexico, there are Mancos clay outcrops in the Sanostee region and as far south as Toadlena, New Mexico. Toadlena is less than 20 linear miles from Sheep Springs. The Mancos clay habitat in the Sanostee and

Toadlena areas should be checked for the Mesa Verde cactus. This could link the Shiprock and Sheep Springs populations and thus give a continuous narrow belt.

The Mancos Formation is also exposed in the area between Grand Junction and Montrose, Colorado, and between Norwood and Dove Creek, Colorado. This potential habitat should be surveyed for the Mesa Verde cactus. The existence and identification of the questionable population on the Uncompahgre Plateau should be established.

All newly discovered populations should be mapped giving exact boundaries.

212. Determine all mechanisms involved in seed dispersal.

It appears that running water is the major factor in carrying seeds away from the parent plants. More study needs to be done to determine if birds and/or rodents play a role in the dispersal of Mesa Verde cactus seeds.

213. Determine the number of years involved in seed germination and dormancy requirements.

The number of years before seeds germinate in their natural habitat is unknown, but apparently the seeds require alternative freezing and thawing periods for successful germination. Seeds must be made available to reputable persons so they can determine the exact germination and dormancy

requirements of the Mesa Verde cactus seeds. Once this information is acquired it should be published and made available to all private and commercial dealers. Although it may temporarily increase the pressure to obtain seeds from wild plants, a higher germination rate for seeds and subsequent large-scale commercial propagation would remove some of the collecting pressure on the wild populations in the long term.

214. Determine what microhabitat factors are involved in seedling establishment ecology.

Some seeds fall into cracks of the dry Mancos or Fruitland clay soils where they become buried and may germinate. Apparently these cracks in the soil are needed to bury the Mesa Verde seeds. Other apparent potential habitats with the dry adobe Mancos or Fruitland clay soils do not support the Mesa Verde cactus. A thorough study of the edaphic factors in relation to seedling ecology needs to be done.

215. Determine the germination percentage rate of seeds and the taxon's overall reproductive potential and actual reproductive success.

It is estimated that in the wild less than 1 percent of the seeds produced by the Mesa Verde cactus germinate. Of those seeds that do germinate the number of seedlings that grow to

maturity is unknown. A study needs to be done on the mortality rate of the Mesa Verde cactus seedlings.

216. Determine what insects and/or other invertebrates are involved in the pollination/predation of *Sclerocactus mesae-verdae*.

The major pollinator of *S. mesae-verdae* is a metallic green sweat bee belonging to the family Halictidae. Although no other pollinators have been observed, investigations should be conducted to determine if other insects or other invertebrates are involved in pollination/predation of this cactus.

217. Identify the insect larva that attacks the Mesa Verde cactus.

A study needs to be conducted to determine what species of insect larva burrows into the Mesa Verde cactus and often causes the plant to rot and eventually die and whether or not any control measures should be instituted. Apparently several other taxa of the genus *Sclerocactus* are subject to the same burrowing insect larva.

3. Develop a program for commercial artificial propagation.

Collection pressures are contributing to the decline of the Mesa Verde cactus. The results of the studies under #21 can be used to increase the success at raising *S. mesae-verdae* to promote its commercial artificial propagation in order to relieve the collecting pressure on the wild populations.

31. Develop improved propagation techniques.

Cultivation of seed stock can be speeded by using grafted propagules rather than individuals raised from seed.

32. Provide stock to outlets for commercial use.

Prohibition of collecting will alleviate some pressures but it will also create additional black market demand. Providing stock to trade outlets as soon as possible will help in decreasing the black market demand. Addition of 10,000 plants per year into the commercial pipeline is set as a goal prior to consideration of delisting. This number will be evaluated for adequacy on attainment.

33. Develop a program for salvage of individual Mesa Verde cactus that are unavoidably threatened with destruction.

Major effort should be expended to ensure, through careful planning, that no Mesa Verde cactus will be destroyed by construction and other resource uses. If however, it becomes unavoidable that some cactus will be destroyed, a program to salvage those plants should be developed and implemented.

Salvaged cactus could be transplanted to suitable sites within the historic range of the species, or could be used as nursery stock in research and artificial propagation studies.

4. Develop public awareness, appreciation, and support for the preservation of the Mesa Verde cactus.

Education of the public is a vital part of this recovery process. The

cooperation of the public is essential for the ultimate success of the foregoing recovery measures.

41. Increase the public's knowledge of the Mesa Verde cactus and its problems, with pamphlets, talk programs, and slide shows.

An appreciation of the Mesa Verde cactus and its role in the environment needs to be developed. This can be started with educational programs such as pamphlets, talk programs, and slide shows.

42. Enlist the support of public interest groups, and particularly the Navajo and Ute Mountain Indian Tribes, for the protection and survival of the Mesa Verde cactus.

Public interest groups, especially local ones such as Native Plant Societies, Lions Club, Rotary, etc., need to be involved. The support of the Navajo and Ute Mountain Indian Tribes is critical. At least 90 percent of the total numbers of Mesa Verde cacti are found on the land of these two tribes.

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PART III - IMPLEMENTATION SCHEDULE

Priorities in column four of the implementation schedule are assigned using the following guidelines:

- Priority one (1) - Those actions absolutely necessary to prevent extinction of the species.
- Priority two (2) - Those actions necessary to maintain the species' current population status.
- Priority three (3) - All other actions necessary to provide for full recovery of the species.

Abbreviations used:

- BIA - USDI Bureau of Indian Affairs
- NIT - Navajo Indian Tribe
- UMIT - Ute Mountain Indian Tribe
- BLM - USDI Bureau of Land Management
- NMHP - New Mexico Heritage Program
- FWS - USDI Fish and Wildlife Service
- SE - Office of Endangered Species
- LE - Law Enforcement

PART III - IMPLEMENTATION SCHEDULE

GENERAL CATEGORY	PLAN TASK (2)	TASK # (3)	PRIORITY # (4)	TASK DURATION (5)	RESPONSIBLE AGENCY			FISCAL YEAR COSTS (EST.)*			COMMENTS	
					FWS		OTHER (7)	FY 1 (8)	FY 2 (8)	FY 3 (8)		
					REGION (6)	PROGRAM (6a)						
(1)											(9)	
O2	Enforce existing regula- tions.	11	1	ongoing	2	LE			2,000	2,000	2,000	
A3	Designate selected por- tions of Mesa Verde cac- tus habitat on Navajo Indian Reservation as restricted use areas.	181	1	2	2	SE		BIA NIT	1,000	1,000		
A3	Designate critical por- tions of Mesa Verde cactus habitat on BLM land as ACEC.	20	1	2	2	SE		BLM	1,000	1,000		
I1	Monitor known popula- tions.	13-17	1	ongoing	2	SE		BLM BIA	1,000	1,000	1,000	
I1 & 2	Survey all potential habitat.	121- 123	2	ongoing	2	SE		BLM BIA	5,000	5,000	5,000	
M3	Regulate ORV use in all Navajo IR Mesa Verde cactus habitat.	182	2	1	2	SE		BIA NIT	1,000			

*Costs refer to USFWS expenditures only.

PART III - IMPLEMENTATION SCHEDULE

GENERAL CATEGORY	PLAN TASK (2)	TASK # (3)	PRIORITY # (4)	TASK DURATION (5)	RESPONSIBLE AGENCY			FISCAL YEAR COSTS (EST.)*			COMMENTS	
					FWS		OTHER (7)	FY 1 (8)	FY 2	FY 3		
					REGION (6)	PROGRAM (6a)						
(1)	(2)	(3)	(4)	(5)							(9)	
A3	Develop a cooperative agreement with the Ute Mountain Indian Tribe.	183	2	1	2	SE		BIA UNIT	1,000			
A3	Develop a cooperative agreement with private landowners.	184	2	1	2	SE			1,000			
M3	Develop management plans for federally administered populations.	19	2	1	2	SE		BLM BIA	2,000			
R3, R6	Study the distribution, population biology and ecology.	21	2	5	2	SE			10,000	10,000	10,000	
I7, M1	Develop a program for commercial artificial propagation.	3	3	ongoing	2	SE			10,000	10,000	10,000	Program duration dependent upon commercial demand.
O1	Develop public awareness, appreciation and support.	4	3	ongoing	2	SE		BIA NIT UNIT BLM	5,000	2,500	2,500	

*Costs refer to USFWS expenditures only.

Program
duration
dependent
upon com-
mercial
demand.

PART III - IMPLEMENTATION SCHEDULE

GENERAL CATEGORY	PLAN TASK	TASK #	PRIORITY #	TASK DURATION	RESPONSIBLE AGENCY			FISCAL YEAR COSTS (EST.)*			COMMENTS			
					FWS	OTHER	(7)	FY 1	FY 2	FY 3				
												REGION	PROGRAM	(6a)
(1)	(2)	(3)	(4)	(5)	(6)	(6a)	(7)	(8)	(9)					
I14	Develop study of extent of use in commercial and private collecting.										This will be part of a national study to be developed.			

*Costs refer to USFWS expenditures only.

APPENDIX

LIST OF AGENCIES AND INDIVIDUALS
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APPENDIX - cont.

COMMENTS REGARDING AGENCY REVIEW
DRAFT RECEIVED FROM THE FOLLOWING:

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APPENDIX - cont.

RESPONSE TO COMMENTS ON
AGENCY REVIEW DRAFT

- A-1 Comment was noted; however, the Population Biology section remains in an outline format. With the large amount of data presented in this section, we felt it was more readable in this format.
- A-2 The discrepancy in population estimates was noted and changed to reflect the updated estimates.
- A-3 No density dependence studies have been done to determine if there is a single density of flowering plants which increase seed set. Therefore, the primary objective cannot be further quantified.
- A-4 Suggestion was incorporated.
- A-5 Suggestions were incorporated.
- A-6 Suggestion was incorporated.
- A-7 There are two tasks involved in Task 211; however, they can be done in conjunction with one another in the same study.
- A-8 Because the Mesa Verde cactus blends in with the clay soils of its habitat, it is difficult to locate at any time other than the flowering season therefore the surveys should be conducted during the flowering season to obtain more accurate data.
- A-9 Suggestion was incorporated.
- A-10 Suggestion was incorporated.
- A-11 Suggestion was incorporated.
- B-1 Suggestion was incorporated.
- B-2 Because the majority of the known populations of Mesa Verde cactus are on Navajo Indian Reservation lands, a letter was sent to the Navajo Tribal Council requesting their recommendations regarding the proposal of a restricted use area. We are awaiting the Navajo Tribe's input for the restricted use area on their land.
- B-3 Trampling has been observed to destroy some of the plants, as well as foraging of the plant tops. Also, there is a lot of pesticide use in the Farmington area and this threat needs to be addressed and monitored.

APPENDIX - cont.

RESPONSE TO COMMENTS ON
AGENCY REVIEW DRAFT -cont.

- B-4 Adequate surveys have been done on NMGS powerplant site. In addition, BLM has plans to survey potential habitat on BLM administered lands in 1984.
- B-5 In the past, people have had little luck with transplanting the Mesa Verde cactus. Therefore, the first priority for seeds in the seed bank will be the development of stock for the artificial propagation program in order to alleviate the collecting pressure. After that is established, replanting of reclaimed areas with the Mesa Verde cactus will be initiated where it is appropriate. An extensive reclamation process is not necessary because the primary objective of this recovery plan is the protection of Mesa Verde cactus habitat.
- B-6 Suggestion was incorporated.
- B-7 Suggestion was incorporated.
- B-8 Comment was incorporated.
- B-9 Comment was incorporated.
- B-10 Suggestion was incorporated.
- B-11 At present Section 6 funds are not available to BIA and/or the Navajo Tribe; they are only available to the individual States.
- C-1 Comments were noted.
- D-1 Suggestion was incorporated.
- D-2 Suggestion was incorporated.
- D-3 Suggestion was incorporated.
- D-4 We concur with your comment.
- D-5 Suggestion was incorporated.



-55-

United States Department of the Interior

FISH AND WILDLIFE SERVICE

WASHINGTON, D.C. 20240

ADDRESS ONLY THE DIRECTOR,
FISH AND WILDLIFE SERVICE

In Reply Refer To:
FWS/OES

MEMORANDUM

To: Regional Director, Region 2 (ARD/AFF)

From: Director

Subject: Comments on Agency Review Draft - Mesa Verde Cactus Recovery Plan

We have reviewed the subject plan and have attached pages of the plan with comments (both editorial and substantive) noted in the margin. Additional comments are as follows:

- A-1 1. Most of the plan is written in a narrative format, but the Population Biology section is written in an outline-type format. The plan should be consistent (either narrative or outline) throughout.
- A-2 2. The population estimates on pages 6-7 do not agree. In one place, the total population is estimated at 4000-5000 plants. In another place, the estimate for one population is placed at 1000 plants with the rest of the populations estimated at 4000-15000 plants. This should give a total of 5000-16000 plants.
- A-3 3. Can the primary objective (page 22) be further quantified? For example, is there a minimum number of cacti necessary in each population?
- A-4 4. The Service's goal for this species is to recover it to the point where it can be delisted. The recovery plan should provide criteria which when met will allow the plant to be considered for reclassification. These criteria should appear in Part II.
- A-5 5. Task 18 of the Step-down Outline/Narrative includes obtaining cooperative agreements with private landowners and the Navajo and Ute Mountain Tribes. The subtasks (181 and 182) deal only with Navajo Indian Reservation lands. Additional subtasks for the Ute Mountain Tribe and private landowners need to be included. Also, there are no criteria discussed to determine which "selected portions of...cactus habitat" should be designated as restricted use areas.
- A-6 6. Tasks 182 and 43 overlap considerably. Task 182 can probably be incorporated into Task 43.

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Robert E. Simmons

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- A-7 7. Task 211 is really two tasks, i.e., (1) survey certain areas and (2) map known and potential sites. Also, if specific sites are mapped, collecting pressure could increase if the files are open to public scrutiny.
- A-8 8. There are numerous tasks requiring surveys for Mesa Verde cactus. Should the surveys be done at any time of the year or should they be done during the flowering season (as required in Task 123)?
- A-9 9. The Implementation Schedule is incomplete in that all tasks (or subtasks) are not included. The schedule also provides for funding some tasks for a longer duration than called for (example - Task 217), funding for too short a time (example - Task 181) or no funding at all (example - Task 121). It is also unclear in many instances which agency will incur the estimated costs (example - Task 18).
- A-10 10. In order to determine the estimated costs of a task, either the task itself must have a total cost figure or every subtask must have a cost figure. The schedule presented does not do this. For example, Task 18 has two different entries and subtasks 181 and 182 have entries. Are the costs of the subtasks included in the cost of the task? What is the cost of the task? If it has been listed twice, do we pay for it twice? Theoretically, the sum of each subtask should be the cost of the task:
- $\text{Cost of 181} + \text{182} = \text{Cost of 18.}$
- A-11 11. The Literature Cited section needs to be checked carefully to insure that all citations in the text appear in this section and that references occurring in the section have actually been cited in the text. Also, the BLM, 1979 text citation appears as U.S. Department of the Interior, 1979 in the Literature Cited section.

We hope these comments will be of value in completing this plan. If you disagree with any of the comments, please provide your rationale in the return cover memorandum. Because of the incomplete nature of the Implementation Schedule, we are asking you to provide five copies of another agency draft for our review. While this will cause a delay in final approval of the plan, there should still be ample time to complete and approve a final plan in FY 84.

Attachments

Received from Bureau of Indian Affairs

memorandum

DATE: DEC - 5 1983

Acting Assistant
PLY TO: Area Director
TTN OF:

SUBJECT: Agency Review Draft Recovery Plan for Sclerocactus mesae-verdae

to: Regional Director, U.S. Fish and Wildlife Service
Albuquerque, New Mexico
Attention: Endangered Species Office

Ed Sp. R-2
JOHNSON
Bowman
Carley
Hawthorn
Holmes
Kelley
M. G. G. G.
KAYSER
H. G.
P. G.
SANCHEZ

We have reviewed the subject recovery plan and would offer the following comments:

- B-1 1. In several sections of the recovery plan it states that the only mesa verde cactus habitat directly under Federal control is the area located on Bureau of Land Management (BLM) land. Were you aware that both the Ute and Navajo Reservations are both Federal lands under the administration of the Bureau of Indian Affairs (BIA)? This point needs to be clarified, expanded upon and corrected in the recovery plan.
- B-2 2. On Page 33, paragraph 181, of the text it is proposed that portions of the Navajo Reservation be designated as "Restricted Use Areas" for the mesa verde cactus. This idea or proposal needs to be expanded upon. Some of the needed information is as follows:
 - (a) How many of these areas do you believe should be established?
 - (b) What will be the approximate acreage of these areas?
 - (c) How will the restricted use of these areas be enforced?
 - (d) Who will do the enforcing?
 - (e) Who will provide the funding for enforcement, establishment and maintenance of these areas?
- B-3 3. Items 6 and 9 on Page 12, is there data available to substantiate these potential threats?
- B-4 4. Third from last paragraph on Page 14, have adequate surveys for this species been completed on New Mexico Generating Station power plant site and areas adjacent to the site, that have potential for impact to the species?
- B-5 5. First paragraph on Page 15, we recommend a plan for accelerated establishment of mesa verde cactus on mining areas be part of the reclamation process, since most of this species habitat will be mined in the foreseeable future.
- B-6 6. Second paragraph on Page 15, we recommend that you contact the Santa Fe Railroad in regard to the extent of possible railroad construction. It is doubtful that the northern limits of railroad construction will be Gallo Wash as stated in the Recovery Plan.

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B-7 7. First paragraph on Page 16, we suggest you contact the BIA Albuquerque Area Office in regard to their survey policy for Threatened and/or Endangered Species on Indian lands under their jurisdiction.

B-8 8. First paragraph on Page 19, is data available regarding the 90% loss of plants due to rot?

B-9 9. Item 7 on Page 20, it should be noted that additional plants have been found within the right-of-way along BIA Route N36 and damage has already occurred to some of these plants during the preconstruction survey of the right-of-way.

B-10 10. Paragraph 1211 on Page 28, it should be emphasized that Indian lands are Federal lands.

B-11 11. Part III on Page 46, were Section 6 funds to be made available to BIA and/or Navajo Tribe for the proposed implementation schedule?

Thank you for the opportunity to review this draft recovery plan and I hope these comments can be of some assistance to you and your organization.

A handwritten signature in cursive script, reading "Charles F. Jones". The signature is written in dark ink and is positioned centrally below the typed text.

-59-

The Nature Conservancy

New Mexico Field Office
Post Office Box 1846 / Albuquerque, New Mexico 87103
610 Gold S.W. Suite 216
(505) 242-2015

December 8, 1983

Mr. S. J. 12	
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Dr. Russell Kologiski
Endangered Species Office
U. S. Fish & Wildlife Service
P. O. Box 1306
Albuquerque, New Mexico 87103

Dear Rusty:

I have reviewed the agency review Draft Recovery Plan for Eriogonum gypsophilum and Sclerocactus mesae-verdae and I have the following comments:

1. Eriogonum gypsophilum - I think that your analysis of impacts of grazing by cattle on Eriogonum are not warranted in that no study has been made to prove whether or not grazing does in fact impact this species. It seems to me that you would have to set up some kind of an enclosure there to determine this as you are planning to do with Echinocereus kuenzleri. I would hope that the BLM would be willing to work out some kind of an arrangement with you, especially in that the grazing values in this area must be minimal. I would imagine from what I have seen of the area that grazing is not a serious problem but on the other hand the population is restricted to such a small area that it seems to me that the Fish and Wildlife Service has the responsibility to ensure that the situation does not get any worse there. My understanding is that the BLM is not interested in seeing the area excluded from grazing but this does not mean that Fish and Wildlife should not push them on this, at least for a period of time to determine whether or not grazing does in fact have an impact. I, as the State Director of The Nature Conservancy, would like to meet with the BLM to discuss this matter and possible to talk to the BLM permittee there to find out if he would go along with this kind of action.
2. I do not accept the premise that if an area is fenced that it would be cut by ORV users. It seems to me that this is like saying that since there may be some opposition to protection of the plant that we shouldn't do anything to try to protect it. My feeling is that we ought to sit down with the BLM and the person who has the grazing permit there and see if we can keep ORV's off. Even if we are unable to keep cattle off, possible we could stretch some kind of a convenience fence across the area next to the road to prevent ORV impacts. We know for a fact that ORV users would have damaging effects on the plants and we also know that cattlemen oppose ORV recreation on their grazing lands. Given the fact that this is one of the rarest plants in New Mexico, I

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al Office
orth Kent Street
Virginia 22209



Western Regional Office
156 Second Street
San Francisco, California 94105

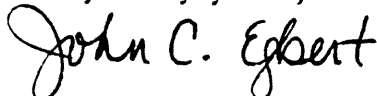
Dr. Russell Kologiski
Page Two

think we should take a hard stand on this and I plan on doing just that. I will do so diplomatically in that I don't want to turn anyone off or end up with a worse situation than already exists. I realize that the plant has survived all that has been done to it in the past but TNC's point of view is that the future may indicate new human use patterns and we would hate to see this plant extirpated. The Brantly Dam proposal does not worry me that much and I feel your comments are adequate.

In general, I think your strategy to protect the plant is good and we support your reffort in that regard.

- C-1
3. Sclerocactus mesae-verdae - Since many threats exist for mesae-verdae cactus, it seems to me that the best thing that can be done is to set up a preserve for this species. Anything that can be done to integrate surface and mineral rights into a package and to centrally put a fence around the area or at least to gain clear ownership of the area would be the best strategy. At the same time, it would be important to do this in as secretive a manner as possible because of collection pressures. Since I have not seen the site nor have I talked to you at length about this, I would be interested in helping in any way to ensure protection for this species. If for example, lands need to be purchased or some kind of management agreement needs to be worked out with a private party, I offer my services. Please let me know if I can be of assistance in this regard.

Very truly yours,



John C. Egbert

JCE/mh

COLLEGE OF ARTS AND SCIENCES
DEPARTMENT OF BIOLOGY
Box 3AF/Las Cruces, New Mexico 88003
Telephone (505) 646-3611



November 23, 1983

Mr. James E. Johnson
Assistant Acting Regional Director
U.S. Fish and Wildlife Service
P.O. Box 1306
Albuquerque, NM 87103

Dear Mr. Johnson:

I have reviewed Ken Heil's recovery plan for Sclerocactus mesae-verdae. In general I find it quite adequate.

Although it does not affect the understandability of the plan, Mr. Heil might go through the plan specifically examining the use of the comma. They are put where not needed, and omitted from where they should be.

D-1 Page 4 - "Foster, 1983," is cited, but I do not find this reference

D-2 Page 8 - Paragraph d: Low success rate for seedlings may be due to "intense competition," but I doubt it. This implies crowding. I suggest in the barren, extreme habitat in which these plants occur that this is not the case. Aspects of the physical environment probably are much more important, such as depth seed is buried, duration of moisture around the seed, packing of soil, temperature, ect.

D-3 Page 8 - Paragraph e, second paragraph: In 1983, I returned to a site just south of Shiprock where several years earlier I found many plants. Now I found mostly holes in the clay and plants were rare. Toward the end of the same paragraph I'd be stronger. Since establishment of new plants, even from a large seed bank (?) is rare, collectors can be expected to have a very strong impact on the population.

D-4 Page 18, bottom: Seed collecting probably has little impact, and certainly is better than digging up the plants. There should be seed reserves in the soil.

D-5 Page 40, paragraph 3: I think it unreasonable to assume successful transplanting of these plants can be achieved in the field. The habitat is too severe to expect the plant to withstand such disturbance. If it is unavoidable that some plants be destroyed, use them as nursery stock somewhere where responsible breeding will be attempted.

Sincerely,

Richard Spellenberg
Professor of Biology

RS/mjb

-62-
United States Department of the Interior

Thank you for allowing us to provide our review and comments to these two draft recovery plans. We apologize for our delay in getting these comments back to you in the stated time frame.

Richard M. Wilson
Acting