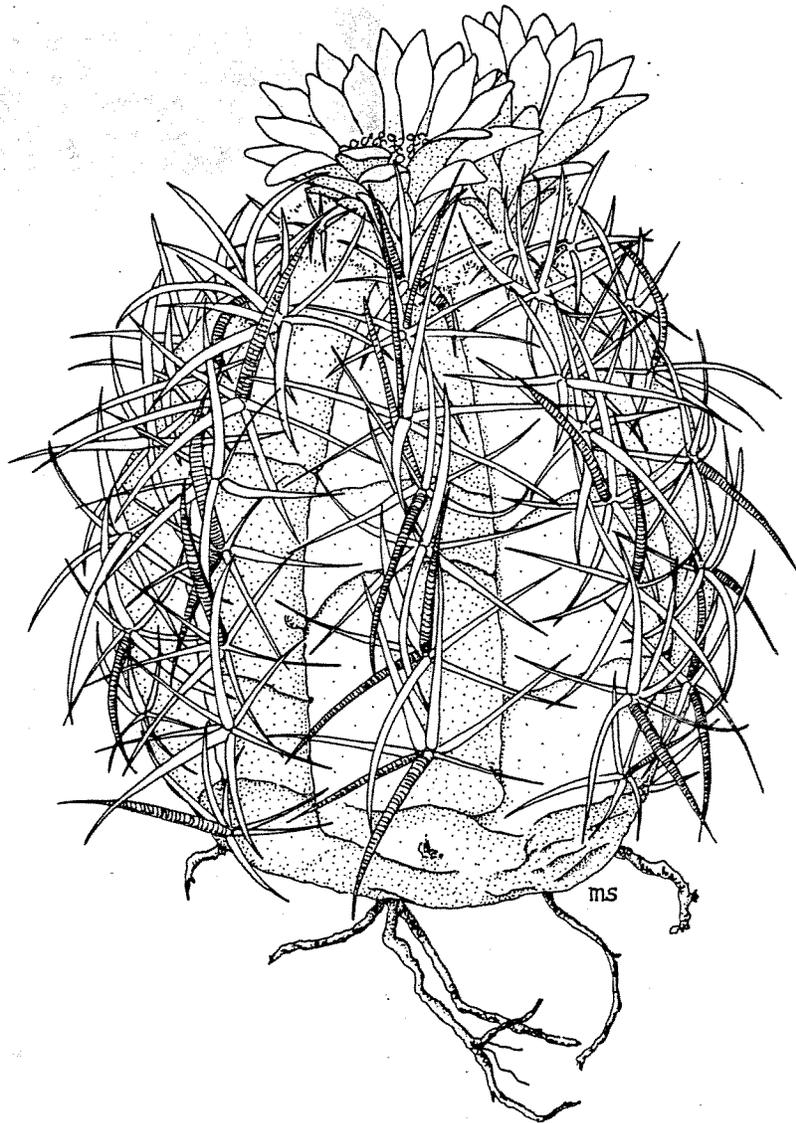


NICHOL TURK'S HEAD CACTUS

(Echinocactus horizonthalonius var. nicholii)

RECOVERY PLAN



U.S. Fish and Wildlife Service
Albuquerque, New Mexico

1986

RECOVERY PLAN FOR THE NICHOL TURK'S HEAD CACTUS

(Echinocactus horizontalonius Lemaire, var.
nicholii L. Benson)

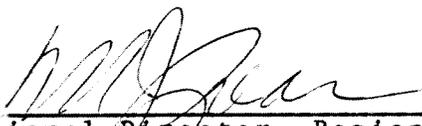
Prepared by:

Clayton J. May, Pima Community College, Tucson, Arizona
Thomas R. Van Devender, Arizona Sonora Desert Museum, Tucson, Arizona
Thomas C. Gibson, University of Arizona, Tucson, Arizona
Mary Butterwick, Bureau of Land Management, Phoenix, Arizona
Peggy Olwell, U.S. Fish and Wildlife Service, Albuquerque, New Mexico

for

Region 2
U.S. Fish and Wildlife Service
Albuquerque, New Mexico

Approved:


Regional Director, Region 2

Date:


4/14/86

DISCLAIMER

This is the completed Nichol Turk's Head 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 does not necessarily represent the views of all individuals who played a role in preparing this plan. This plan is subject to modification as dictated by new findings, 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 constraints.

Literature Citations should read as follows:

U.S. Fish and Wildlife Service. 1986. Recovery Plan for the Nichol Turk's Head Cactus (Echinocactus horizonthalonius var. nicholii). U.S. Fish and Wildlife Service, Albuquerque, New Mexico. 68 pp.

Additional copies may be purchased from:

Fish and Wildlife Reference Service
6011 Executive Blvd.
Rockville, Maryland 20852
301/770-3000
or
1-800-582-3421

ACKNOWLEDGEMENTS

Information and assistance in preparation of this plan were provided by Arizona Plant Recovery Team members: Dr. Arthur Phillips, Dr. Donald Pinkava, and Mr. Reggie Fletcher.

In addition, we would like to acknowledge the technical assistance and comments of Dr. Edward F. Anderson (Whitman College, Walla Walla, Washington), Mr. Ken Heil, Mr. Don Brechenfeld (Soil Conservation Service), Mr. Patrick Williams (Bureau of Indian Affairs), and botanists from the Washington Office of Endangered Species.

SUMMARY

1. GOAL: To remove Echinocactus horizonthalonius var. nicholii from the Federal list of endangered and threatened species by managing and protecting the essential habitat of the existing populations and by decreasing collection pressure.
2. RECOVERY CRITERIA: The criteria for downlisting of the Nichol Turk's head cactus to threatened status is permanent protection of 75 percent of the known habitat according to the steps outlined in this plan. The downlisting criteria will be reevaluated for adequacy upon attainment or when data indicates that the criterion can be revised. The criteria for delisting cannot be established now. It is only after a complete census of plants within the known habitat and other necessary studies are conducted that quantification of criteria for delisting can be established.
3. RECOVERY ACTIONS: Major steps needed to meet the recovery criteria include: developing and implementing habitat management plans that alleviate the threats of mining, ORV use and collecting; enforcing existing regulations on collecting, trade and mining; searching for new populations of E. horizonthalonius; var. nicholii; monitoring and studying existing populations; and developing a cactus trade management plan for all cacti.

TABLE OF CONTENTS

	Page
DISCLAIMER	i
ACKNOWLEDGEMENTS	ii
SUMMARY	iii
PART I. INTRODUCTION	1
Taxonomy and Description	2
Distribution and Land Ownership	3
Habitat	6
Impacts and Threats	9
Management and Conservation Efforts	13
PART II. RECOVERY	16
Prime Objective	16
Step-down Outline	17
Narrative	20
Literature Cited	37
PART III. IMPLEMENTATION SCHEDULE	38
APPENDIX I. Summary of Clay May ^o 's Research	43
APPENDIX II. List of Reviewers	53
Comments Received	54
Responses to Comments	55

PART I

INTRODUCTION

On October 26, 1979, the U.S. Fish and Wildlife Service determined Echinocactus horizionthalonius var. nicholii to be an endangered species (44 FR 61929), thereby protecting this cactus under the Endangered Species Act of 1973, as amended. The Nichol Turk's head cactus is presently known from two areas in the lowlands of the Sonoran Desert in south-central Arizona: the Waterman Mountains in north-central Pima County and the Vekol Mountains in southwestern Pinal County. The species is threatened by destruction of habitat due to mining and off-road vehicles (ORVs) and by collection (Phillips et al. 1979; C. May, pers. comm. 1984).

The objective of this recovery plan is to outline a means for facilitating the recovery of Echinocactus horizionthalonius var. nicholii by managing and protecting the existing populations and their habitat and by decreasing collecting pressure on its populations in the wild. The documentation of long-term stability of the populations and removal of threats to the cactus and its habitat will lead to the ultimate objective of removal of Nichol Turk's head cactus from the Federal list of endangered and threatened species.

Taxonomy and Description

While known in Arizona since 1918 when Forrest Shreve collected a specimen of Nichol Turk's head cactus from Pima County, the Arizona populations were only recently named as a distinct variety, nicholii (Benson 1969). Variety nicholii differs from variety horizontalonius by the former's tall stem size, 40-50 cm (16 to 20 inches); the number of radial spines per areole, 5; the longer than broad seeds; and the spine color, nearly black or dark gray. Variety nicholii grows in the Sonoran Desert whereas variety horizontalonius grows in the Chihuahuan Desert in southern New Mexico and western Texas (Benson 1972). The nearest population of variety horizontalonius is near Las Cruces, NM, about 280 miles east of the Waterman Mountains.

Several other varietal names, including centrispinus, curvispinus, moelleri, and obscurispinus have been given to this taxon, but are not presently used by most cactus specialists. Weniger (1970) used E. h. var. moelleri Haage Jr. to include plants from the El Paso area in Texas west to Arizona. Benson (1982) concludes that it is a nomen nudem because it lacked a Latin diagnosis, a type specimen, or a previous page reference and included it under the synonymy of E. h. var. horizontalonius.

Nichol Turk's head cactus is a small, blue-green barrel cactus, reaching a maximum height of 45 cm (17.7 inches) and a diameter of 20 cm (7.9 inches). It produces bright purple flowers, which, when pollinated, develop into soft, woolly, white fruits. There are commonly eight ribs on the plants, which usually spiral on the trunk of mature plants. Each areole consists of three robust central spines and five radial spines. This cactus invariably has a single stem, but often several seedlings grow around its base, giving the appearance of small clumps.

Distribution and Land Ownership

Until recently it was thought that the Nichol Turk's head cactus occurred only in Arizona (Benson 1982). The range was extended with the discovery of a population in northwestern Mexico (Yatskievych & Fisher 1984). This range extension was based on a single immature herbarium specimen with five radial spines. The plants were restricted to a few limestone ridgetops and were found to be uncommon (Yatskievych & Fisher 1984).

Presently, Nichol Turk's head cactus is known to occur in two disjunct populations in the U.S. and one population in Mexico. The U.S. populations are in the Vekol Mountains in

southwestern Pinal County, Arizona, and in the Waterman Mountains of north-central Pima County, Arizona, (Fig. 1) (Phillips et al. 1979). The Mexican population occurs in the Sierra del Viejo of northwestern Sonora, Mexico (Yatski-evych & Fisher 1984).

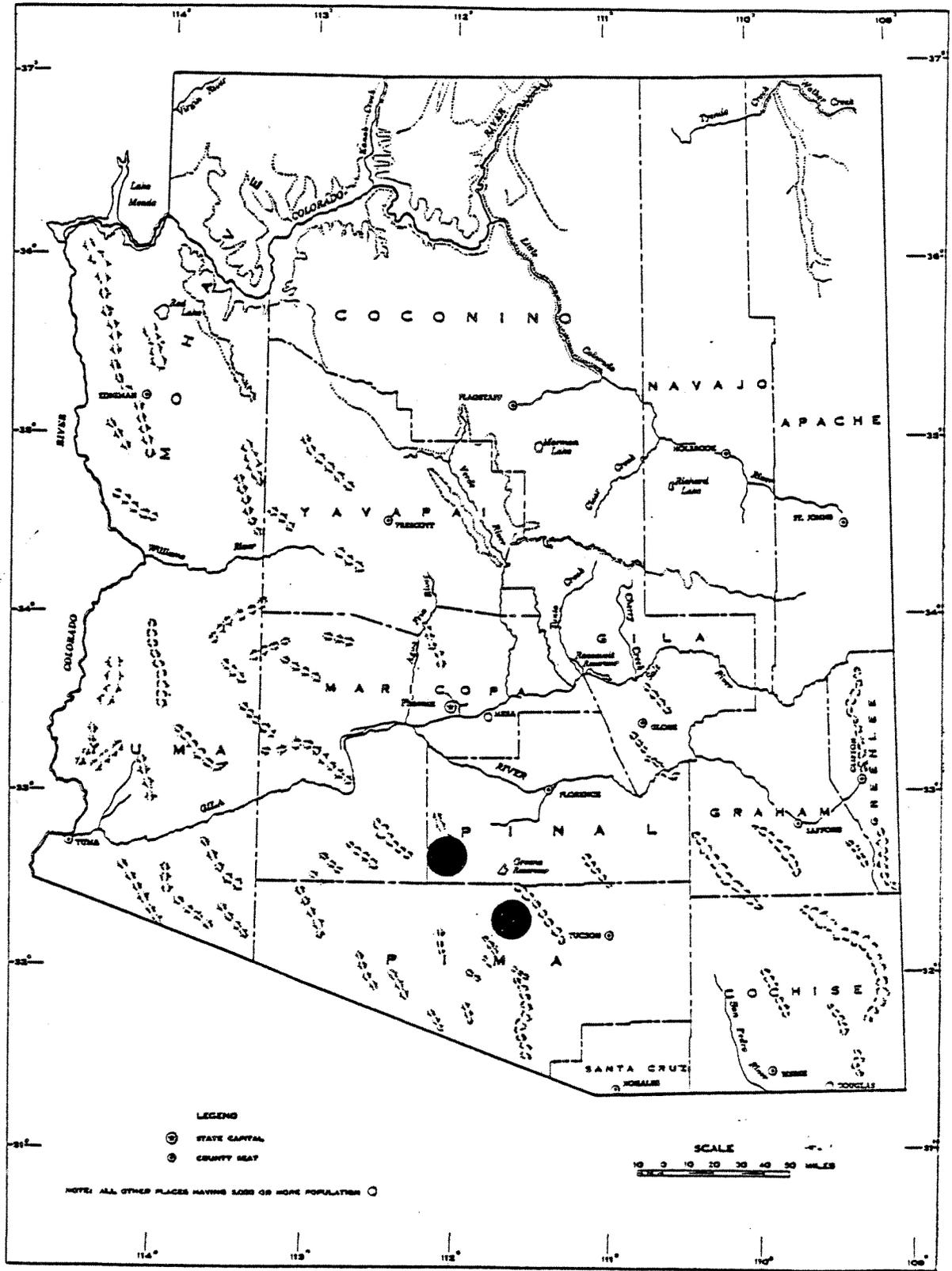


Figure 1. Localities of U.S. populations of Nichol Turk's head cactus.

The total distribution of this species is not yet completely delineated. Available data indicate that the species occurs on land administered by the Bureau of Land Management (BLM); the Bureau of Indian Affairs (BIA); Papago Indian Reservation; and on State of Arizona, and privately owned lands.

Habitat

Nichol Turks's head cactus grows on both alluvial fans and inclined terraces and saddles of the Vekol and Waterman Mountains on limestone-derived soils between 1,000 meters (3,281 feet) and 1,167 meters (3,829 feet) (Phillips et al. 1979). In the Vekol Mountains, Nichol Turk's head cactus has been observed on both Lozier and Tencee soil series, which are carbonatic soils consisting of greater than 40 percent calcium carbonate in the soil (D. Breckenfeld, SCS, pers. comm. 1985). The soil classification for the Waterman Mountains population has not been determined.

The taxon occurs within the Arizona Upland Division of the Sonoran Desert scrub (Brown and Lowe 1980). Vegetation is open and characterized by sparse trees and scattered low shrubs. The dominant associated species are foothill palo verde (Cercidium microphyllum), triangleleaf bursage

(Ambrosia deltoidea), white ratany (Krameria grayi), and prickly pear cactus (Opuntia sp.) (Phillips et al. 1979).

Climate as reported at the meteorological station at Silver Bell, which is situated at 823 meters (2,700 feet) elevation, is semi-arid with less than 33 cm (13 inches) of precipitation in most years (Sellers and Hill 1974). The rainfall is strongly biseasonal with more than half of the rain falling between July and September in summer thunderstorms. Rain also falls in the cool season in midwinter and early spring. Summer temperatures are warm, with a July daily mean maximum of 99.1° F. Freezing temperatures occur on an average of only five nights during the winter. Night temperatures of Silver Bell and Waterman Mountains are relatively warm due to cold air drainage from the slopes into the valleys.

Geology of the Waterman Mountains was studied by McClymonds (1957). The mountains were formed by thrusting of Precambrian granite and Paleozoic sediments through younger Cretaceous rocks. Paleozoic sediments include the entire section between the Cambrian and Permian in a fold that has been broken by a series of faults and then eroded. Deformation of the rocks may have continued as late as the middle Tertiary (25-30 million years ago).

In the southern Waterman Mountains E. h. var. nicholii is found on the Pennsylvania Horquilla Limestone, the Permian Earp Formation, and the Permian Concha Limestone. Most of the populations are on Quaternary alluvium derived from the adjacent bedrock; however, some of the populations grow on bedrock terraces and saddles on the mountain proper. In the alluvial fan area, the cactus grows along the edges of washes in dendritic patterns. Plants growing on the mountain occur in habitats with more emergent rock than those on the alluvial fans.

On both alluvial fans and bedrock terraces, the associated vegetation contains few trees or shrubs, producing an open aspect to the cactus' environment. The lower end of the alluvial fan is characterized by high densities of shrubs and trees, producing an almost closed canopy. Here, despite presence of limestone and suitable scarps, the cactus is limited in numbers, growing only along open wash scarps in isolated populations. Shaded plants in several isolated populations presently being overgrown by shrubs are growing, flowering, and surviving at lower rates than those plants in open areas. This suggests that this cactus is a poor competitor with shrubs and trees for space, moisture, light, and nutrients. It is able to persist on limestone outcrops because the colonization rates of shrubs and trees onto such extreme soil types are low.

Small outcrops of similar limestone, where the cactus is not known, occur to the west of the Waterman Mountains in Pima (Koht Kohl Hills, Santa Rosa, Cimarron, Brownell, Sierra Blanca, and Growler Mountains) and Pinal (Slate Mountains and Vaiva Hills) Counties, Arizona. Estimated potential habitat in the Waterman Mountains is 5,000 acres and estimated potential habitat in the Vekol Mountains is 5,700 acres. The number of individuals in all populations is estimated to be near 10,000 (May, pers. comm. 1985).

Impacts and Threats

When Nichol Turk's head cactus was listed, the species was threatened by several factors, including copper mining operations, urban development, off-road vehicle use, and over-collection. There was no evidence of recent grazing within the distribution of the plant on BLM administered lands at that time. The following are existing or potential threats to the species.

1. Mining: Active limestone quarrying has already extirpated a small population growing on patented land near the Happy Jack Mine in the Waterman Mountains. Roads leading to this quarry have cut through several populations, and erosion is burying and washing out plants. The Happy Jack

Mine also constructed an airstrip on BLM land that removed an estimated 350 plants. In addition, the Happy Jack Mine has expressed an interest in developing its unpatented mining claims near the Silver Hill Mine and thereby may impact Nichol Turk's head cactus populations in that area. The Waterman Mountains are mineral-rich with metals such as copper, silver, and gold. More importantly, these mountains contain high-grade lime that is used in processing sugar beets and as a major ingredient in cement. Generally, milling the stone into fine powder is done on site and can generate large amounts of dust that may severely impact this plant. Dust coatings may harden on the plant with little moisture. This condition would restrict light penetration on to the plant, thereby reducing the photosynthetic rate and creating a negative carbon balance. The effects of this type of chronic affliction might not be expressed for several years; however, the first symptom of this kind of impact may be manifested in a lower reproductive rate.

The principal metallic commodities in the Vekol Mountain area are silver, gold, copper, zinc, and lead. Other non-metallic commodities that occur in the general area are silica, perlite, and fluorspar (letter to M. Butterwick from M.N. Greeley, Arizona Department of Mines and Minerals Resources 1985). Very little is known about mining impacts and threats on the cactus populations in the Vekol Mountains,

although a known population is adjacent to an active mine site. In addition, a portion of the population occurs on patented land with no legal protection.

2. Off-road vehicle use: In the Waterman Mountains, May (unpublished data) has observed a number of plants killed by recreational vehicles, particularly motorcycles and all-terrain vehicles, from 1974-1982. Motorists tend to use habitat occupied by the cactus, as these regions are relatively open. Off-road vehicles are using and expanding the roads constructed by mines, as well as cutting new trails and allowing greater penetration into the plant's habitat. This is particularly evident in the southern part of the Waterman Mountains. Destruction rates are highest near roads. At one time camping by winter visitors and others along the Papago Indian Reservation boundary in the western part of the mountain range was a yearly event. Vehicles parked in open spaces destroyed a large number of this population. The Papagos closed and locked the gate across this road to prevent access to their land. Since this closure, ORV users have cut the fence many times to gain access to Indian land.

3. Collecting: Marked plants have been removed from the study sites in the Waterman Mountains and about 20 individuals in the Tucson area alone are known to have field-dug

plants in their collections. Field collected specimens of the cactus have been seen in landscaped areas in Silver Bell (Phillips et al. 1979) and recently in gardens owned by mining companies. In 1985, TRAFFIC (U.S.A.) analyzed the trade in U.S. cactus and succulents between 1982 and 1984. Nichol Turk's head cactus was offered for sale in eleven catalogs with prices from \$0.65 to \$15. Two of those catalogs specified field-collected plants (Fuller 1985).

Seed collection by commercial cactus nurseries may be a serious problem because collecting methods can damage the apical meristem of this cactus and prevent further growth and flowering. At least one nursery collects seed in this area, and some plants appear to have been permanently damaged by this practice (May, unpublished data).

4. Other factors: In one population, numerous plants show evidence of being bullet-scarred. Expansion of a town dump in this area would also destroy plants. Lastly, moderate grazing does not appear to affect this cactus, for cows seem to avoid stepping on larger plants (May, pers. obs. 1984). However, an increase in stocking rates, construction of water development, or seed imprinting could impact the species. When the Waterman Peak Allotment Management Plan (AMP) is developed, the conservation of the Nichol Turk's head cactus should be included.

Management and Conservation Efforts

Legal Protection

Echinocactus horizionthalonius var. nicholii is on the Arizona State protected list, Arizona Native Plant law (ANPL). Arizona Revised Statute, Chapter 7, Sec. 3-901(C). This law prohibits collecting this cactus except by permit. On July 29, 1983, Echinocactus horizionthalonius var. nicholii was placed on Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), which requires permits from both the importing and exporting countries before shipment may occur. Only scientific trade benefitting survival of the species is allowed.

The Endangered Species Act of 1973, as amended in 1982, prohibits removal (from Federal lands) and reduction to possession of plants listed under the provisions of the Act. It is also prohibited for any person subject to the jurisdiction of the United States to sell, offer for sale, import, export, or transport in interstate or foreign commerce in the course of a commercial activity, any listed plant species. Under certain circumstances, the Act also provides for the issuance of permits to carry out otherwise prohibited activities involving listed species.

The Lacey Act, as amended in 1981, also provides some protection for the Nichol Turk's head cactus. Under this Act it is prohibited to import, export, sell, receive, acquire, purchase or engage in the interstate or foreign commerce of any plant taken, possessed, or sold in violation of any law, treaty, or regulation of the United States, any Indian tribal law, or any law or regulation of any State.

Monitoring Efforts

Three populations of Nichol Turk's head cactus have been monitored in the Waterman Mountains since 1978 by Clay May. Growth rate, reproductive capacity, and age structure of these three populations have been documented. Data demonstrate the slow and variable population dynamics of this species (see Appendix I).

In 1983, BLM personnel mapped and labelled 1,179 Nichol Turk's head cactus on the north side of Waterman Peak near a mining operation (Butterwick, pers. comm. 1983). In 1984, a sample was relocated; however, no population data were collected. Reproductive data are necessary as baseline data for this population to determine any effects from the mining operation. In addition to the monitoring program, BLM is developing a Habitat Management Plan that will address the

management of the species on about 2,365 acres of public lands (M. Butterwick, pers. comm. 1985). BLM may acquire 590 acres of State lands in the vicinity of Waterman Peak as well as 550 acres of patented land. Management of the species by BLM on these lands will not occur until BLM acquires the parcels.

The Bureau of Indian Affairs (BIA) does not have an active monitoring program for the cactus in effect; however, soils mapping of the Papago Indian Reservation is being conducted by Soil Conservation Service (SCS) personnel. These people are also marking occurrence of the cacti when it is encountered in the field.

PART II

RECOVERY

Prime Objective

The prime objective of this recovery plan is to manage and protect the essential habitat of Echinocactus horizonthalonius var. nicholii so that healthy populations can be sustained in their natural habitat at a level where the species can be removed from the Federal Endangered Species List.

The criterion for downlisting to threatened status is permanent protection of 75 percent of the known habitat according to the steps outlined in this plan. The downlisting criterion will be reevaluated for adequacy upon attainment or when data indicates that the criterion can be revised. The criteria for delisting cannot be established now. Funding levels have not allowed complete census of plants within the known habitat and it is only after necessary studies are conducted that quantification of criteria for delisting can be established.

Step-down Outline

1. Maintain, protect, and enhance natural populations.
 11. Protect the existing populations by cooperating with other Federal and State agencies to enforce existing regulations.
 111. Cooperate with the State of Arizona to enforce the Arizona Native Plant Law (ANPL).
 112. Cooperate with BLM and BIA to enforce existing collecting and trade regulations under ESA, CITES, and Lacey Act.
 113. Ensure compliance with provision 3809.2-2d of the Surface Management of Public Lands regulations and comply with Section 7 of the ESA.
 12. Manage populations on federally administered lands.
 121. Withdraw suitable acres of habitat on BLM from operation of the mining laws.
 122. Monitor populations and habitat on BLM administered lands.
 123. Consolidate Federal ownership of habitat in the Waterman Mountains.
 124. Develop an ORV designation for appropriate portions of the habitat on BLM administered lands.

125. Designate a portion of Nichol Turk's head cactus habitat as an Area of Critical Environmental Concern (ACEC).
 126. Prohibit surface occupancy and the removal of saleable minerals within Nichol Turk's head cactus habitat in the Waterman Mountains.
 127. Survey and monitor populations and habitat on BIA administered lands.
 128. Seek cooperation of BIA for management of Nichol Turk's head cactus.
13. Manage populations on State lands.
 131. Survey and monitor populations and habitat on State of Arizona lands.
 132. Determine Arizona State Land Department responsibilities on lands leased for mineral development.
 133. Seek cooperation of the State of Arizona for protection and management of Nichol Turk's head cactus populations on State lands.
14. Protect populations on private lands.
 141. Survey and monitor populations and habitat on private lands.
 142. Seek cooperation of private landowners for protection and management of the Nichol Turk's head cactus.

2. Study populations in their natural habitat at the existing sites.
 21. Study the ecological requirements of Nichol Turk's head cactus.
 211. Soils.
 212. Moisture.
 22. Study the population biology of the cactus.
 221. Life history characteristics.
 222. Demographic trends - monitor population numbers to try to separate the effects of natural cycles from trends resulting from human impacts (collection, ORVs, ect.).
 223. Biotic factors - study the relationship between the cactus and other organisms.
 2231. Herbivores.
 2232. Other organisms.
 23. Search for Nichol Turk's head cactus.
 231. Search the area in Sonora, Mexico where the population exists.
 232. Search for new locations.
3. Develop a comprehensive trade management plan (CTMP) for all cacti.
 31. Develop a trade study.
 32. Develop a monitoring study to determine the impact of collecting.

33. Determine the feasibility of reducing the collecting pressure.
34. Develop a law enforcement strategy.
4. Develop public awareness, appreciation, and support for the preservation of the Nichol Turk's head cactus.

Narrative

1. Maintain, protect, and enhance natural populations.

It is important and crucial to the preservation of the Nichol Turk's head cactus to protect populations in the wild. To do this, a continuing program of law enforcement, monitoring, and management must be implemented and coordinated among Federal agencies, the State of Arizona, and private individuals or organizations.

11. Protect the existing populations by cooperating with other Federal and State agencies to enforce existing regulations.

The Arizona Native Plant Law, BLM regulations regarding mineral development, and the Endangered Species Act need to be enforced. Because the major threats to the Nichol Turk's head cactus are habitat destruction and collection, enforcement of regulations are priority one tasks necessary to prevent the irreversible decline of the species.

111. Cooperate with the State of Arizona to enforce the Arizona Native Plant Law (ANPL).

Collection of the taxon is prohibited except under permits by the Arizona Native Plant Law (ARS 3-901C). This law applies to plants occurring on Federal, State, and private lands.

112. Cooperate with BLM and BIA to enforce existing collecting and trade regulations under ESA, CITES, and Lacey Act.

This plant is protected by ESA, CITES, and the Lacey Act. Echinocactus horizionthalonius var. nicholii is listed as endangered under the Endangered Species Act and is included under Appendix I of CITES which contains species believed to be threatened with extinction. Generally, scientific trade beneficial to survival of the species in the wild can be allowed; trade for primarily commercial purposes is strictly prohibited. Under the Lacey Act, it is unlawful to export, import, transport, sell, receive, acquire, or purchase any plant taken or possessed in violation of any law, treaty, or regulation of the U.S., of any Indian tribal law, or of any law or regulation of any State.

113. Ensure compliance with provision 3809.2-2d of the Surface Management of Public Lands regulations and comply with Section 7 of the ESA.

Adequate compliance with the 3809 Surface Management regulations could prevent adverse impacts to endangered species and their habitat from mining operations on BLM administered lands. Mining claimants in the Waterman Peak area should be contacted and informed of the 3809 regulations. Their cooperation is needed to minimize surface disturbance in this area. The Endangered Species Act (Section 7) requires Federal agencies, BIA and BLM, to consult with FWS on any action that may affect Nichol Turk's head cactus or its habitat.

12. Manage populations on federally administered lands.

Maintenance and enhancement of populations on BLM and BIA administered lands can be attained by application of biologically sound management policies to remove threats to the species and by establishment of an ongoing program to survey and monitor the species and its habitat.

121. Withdraw suitable acres of habitat on BLM from operation of the mining laws.

A mineral withdrawal is needed to minimize impacts to the habitat. The existing 3809 Surface Management regulations have not been effective in preventing surface disturbance in this area from mining activities. Title 43, part 2300 of the Code of Federal Regulations provides the procedures for a mineral withdrawal. As claims are relinquished, the areas would automatically be withdrawn.

122. Monitor populations and habitat on BLM administered lands.

During April and May 1983, Nichol Turk's head cacti were mapped and labelled within the boundaries of a mining operation on the north side of Waterman Peak. Monitoring of these populations is needed to document the effect(s) of this activity on the cactus. The design of this monitoring study will include the determinations of the effects of the milling dust on the species. Also, monitoring efforts will include aerial surveillance in the Waterman Mountains. Aerial photographs taken during these flights will document human

activity within the habitat including the blading of roads, ORV use, and the illegal removal of Nichol Turk's head cacti.

123. Consolidate Federal ownership of habitat in the Waterman Mountains.

BLM acquisition of an isolated parcel of State land located in T. 12 S., R. 9 E., Section 32 would improve manageability of the species because the ESA is most effective in protecting populations on Federal land. Also, 550 acres of patented land within Nichol Turk's head cactus habitat should be considered for acquisition.

124. Develop an ORV designation for appropriate portions of the habitat on BLM administered land.

Determine actual ORV use in the area and document the need for a formal designation. Title 43, Part 8360, Subpart 8364 of the Code of Federal Regulations provides the authority and procedures for an ORV closure.

125. Designate a portion of Nichol Turk's head cactus habitat as an Area of Critical Environmental Concern (ACEC).

This area meets both criteria for an ACEC (48 FR 20375). ACEC designation is important in that it constitutes a BLM commitment to carry out special management requirements for the area. The designation process involves the preparation and review of an ACEC plan element, environmental analysis, a notice published in the Federal Register, and a public announcement to other media.

126. Prohibit surface occupancy and the removal of saleable minerals within Nichol Turk's head cactus habitat in the Waterman Mountains.

BLM has the authority to restrict the removal of saleable minerals such as sand and gravel. Nichol Turk's head cactus habitat includes alluvial areas that may be subject to such uses.

127. Survey and monitor populations and habitat on BIA administered lands.

A comprehensive survey for Nichol Turk's head cactus on the Papago Indian Reservation is

needed to determine the distribution of the species on the reservation. An ongoing monitoring program is essential to determine the present and continued status of the populations on the reservation. Potential habitat exists throughout the northern portion of the Papago Indian Reservation where Carboniferous and Devonian limestone occur. Areas of suitable habitat in Sif Vaya, Tat Momolikot, Santa Rosa Mountains, the Slate Mountains, and Vaiva Hills need to be searched for Nichol Turk's head cactus.

128. Seek cooperation of BIA for management of Nichol Turk's head cactus.

To facilitate the management and protection of Nichol Turk's head cactus on BIA lands, a cooperative agreement should be developed. Such an agreement should set forth long-term general management activities that would prevent the loss of plants and habitat due to such actions as mining or mineral exploration, grazing, and ORV activities. Implementation of a management plan on the Papago Indian Reservation is vital to the recovery of the species.

13. Manage populations on State lands.

It is essential for the recovery of the species that populations on State lands are protected and managed. This can be done through the development of a cooperative agreement and a monitoring program.

131. Survey and monitor populations and habitat on State of Arizona lands.

To determine the distribution and status of Nichol Turk's head cactus on State lands, a survey and monitoring program needs to be established.

132. Determine Arizona State Land Department responsibilities on lands leased for mineral development

Determine the extent of the Arizona State Land Department's jurisdiction over leased lands to limit impact on Nichol Turk's head cactus by the leasee.

133. Seek cooperation of the State of Arizona for protection and management of Nichol Turk's head cactus populations on State lands.

To facilitate the management and protection of Nichol Turk's head cactus on State land, a

cooperative agreement should be developed. Such an agreement could be very helpful in expediting the protection of plants on State lands, particularly in enforcing regulations of the ANPL and in developing management plans to address specific activities for the maintenance of the species.

14. Protect populations on private lands.

Although populations on private lands lack the legal protection afforded those on public lands, it is important for the survival of the taxon that attempts be made to secure those populations.

141. Survey and monitor populations and habitat on private lands.

Surveying and monitoring are necessary to ensure maintenance of the existing populations and to avert threats to these populations.

142. Seek cooperation of private landowners for protection and management of the Nichol Turk's head cactus.

On private lands for which the owner is willing to cooperate in behalf of the Nichol Turk's head cactus, understandings should be

attempted as the simplest method of protecting the cactus. Such cooperation should provide for the protection of the cactus and its habitat, for access to the cactus populations by management biologists, and for certain management tasks, including monitoring.

2. Study healthy populations in their natural habitat at the existing sites.

An in-depth knowledge of the plant's ecology and biology is needed to understand its habitat requirements. With this information, sound management decisions can be made and implemented to sustain healthy, natural populations. The use of a well documented and accessible living collection could provide a source of material for these types of studies.

21. Study the ecological requirements of Nichol Turk's head cactus.

Studies on specific geological/edaphic parameters need to be done to determine factors influencing the exact distribution of the cactus. Required components and limiting factors should be determined.

This knowledge will provide an estimate of how much habitat there is and the type of management necessary.

211. Soils.

The depth of soil, nature of limestone, slope, and microhabitat features should be analyzed to determine why seemingly identical areas have no plants. Soil factors such as chemical composition, texture, structure, aeration, and temperature need to be assessed.

212. Moisture.

Hydration of the plant, which is winter rainfall dependent, will determine its successful flowering. Plants that are not fully hydrated (as evidence by wrinkling and flaccid feel) shrink markedly at apical pit, pulling the apical spine groups inward forming a cage of strongly overlapping spines that prevent the emergence and opening of flowers. The timing and amount of rainfall, with resulting moisture equivalence of the soil, at different seasons needs to be determined.

22. Study the population biology of the cactus.

The life history characteristics of the Nichol Turk's head cactus should be studied because they reflect the species' adaptations to its particular environment. Some microhabitats allow higher fecun-

dity and survivorship of individual plants than others, so characteristics of subpopulations can indicate which abiotic and biotic components are most essential to survival of the species. Monitoring plots have been established in four Nichol Turk's head cactus populations. Three have been read once per year for 4 years and one for 2 years. Continued study of these plots and establishment of new plots in different microhabitats are needed to assess trends.

221. Life history characteristics.

The frequency of seedling establishment, survivorship, fecundity, density-dependence of plants related to pollination, and reproductive index of the species are some factors that need to be considered.

222. Demographic trends - monitor population numbers to try to separate the effects of natural cycles from trends resulting from human impacts (collection, ORVs, etc.).

Natural populations often experience cycles in abundance. Overlying this natural variation can be the effects of environmental disturbances induced by human impacts. Suitable sites

for monitoring (i.e., transects and exclosures) should include areas of concentrated livestock use, and areas accessible to collectors. These studies should also include control sites.

223. Biotic factors - study the relationship between the cactus and other organisms.

Biotic factors influencing the survival of Nichol Turk's head cactus need to be studied. Knowledge of such factors may facilitate the recovery of the species.

2231. Herbivores.

Various potential herbivores, primarily rodents and lagomorphs, are abundant in the area. Their roles in the ecology of Nichol Turk's head cactus need to be determined.

2232. Other organisms.

Several species of bees (Centris sp. and Apis mellifera), beetles, wasps, flies, and butterflies have been observed visiting the flowers of the Nichol Turk's head cactus. The relationship of pollinators and seed dispersers needs to be assessed.

23. Search for Nichol Turk's head cactus.

Final inventories are needed to map the exact range of the cactus, to determine if any populations have been overlooked, and to determine its rarity for management plans.

231. Search the area in Sonora, Mexico where the population exists.

Survey the population in Sierra del Viejo, Sonora, Mexico to determine distribution and abundance. Collect materials for morphological and chemical analysis to verify the plant as var. nicholii.

232. Search for new locations.

Similar geologic outcrops and substrate occurring near all known populations should be searched. Several areas on the Papago Indian Reservation need to be intensively surveyed for Nichol Turk's head cactus.

3. Develop a comprehensive trade management plan (CTMP) for all cacti.

Prior to development of trade management strategies, studies are necessary to determine what species are in the trade, the overall trend of trade in listed cacti, the feasibility of reducing the collecting pressure on the wild populations by promoting a commercial artificial propagation program, and to determine strategies for effective implementation of law enforcement responsibilities of ESA, CITES, Lacey Act, and State laws. These studies should be national in scope and address all cacti. Completion of subtasks 31 through 34 will result in development of an FWS policy on the cactus trade problem and will allow the drafting of a CTMP.

31. Develop a trade study.

Documentation of the identity of species in the trade and their source is of primary concern to the development of trade management strategies. This would involve the investigation of the cacti dealers and catalogs, and interviews with knowledgeable individuals.

32. Develop a monitoring study to determine the impact of collecting.

Establish sample plots to monitor listed cacti and cacti suspected of being impacted by trade. Natural changes in populations as well as the success of

recovery efforts would also be measured by the monitoring study. The impact of seed collecting, and taking of cuttings are needed to understand harvest limits on the species.

33. Determine the feasibility of reducing the collecting pressure.

A commercial artificial propagation program may remove some of the collecting pressure on the cacti in the field. Some collectors enjoy raising their own plants from seeds or seedlings and if these are easily and economically available, then the collectors may not turn to field collecting. Other collectors only want field collected plants, so some pressure is likely to remain on the wild populations.

34. Develop a law enforcement strategy.

Evaluate issues involved in enforcing regulations regarding all listed cacti species. Special problems with listed cacti should be addressed in coordination with law enforcement to protect the species.

4. Develop public awareness, appreciation, and support for the preservation of the Nichol Turk's head cactus.

Education of the public is a vital part of the recovery process. The cooperation of the public is essential for the ultimate success of the foregoing recovery measures. Public interest groups, especially local ones such as botanical gardens native plant societies, cactus societies, and The Nature Conservancy chapters need to be involved. The visibility of their support can be instrumental in shaping public opinion. Specific strategies would include lectures, pamphlets, letters, etc., concerning conservation of threatened and endangered plant species.

Literature Cited

- Benson, L. 1969. The Cacti of Arizona. The University of Arizona Press, Tucson, AZ.
- _____. 1982. The Cacti of the United States and Canada. Stanford University Press, Stanford, CA.
- Brown, D.E. and C.H. Lowe. 1980. Biotic communities of the Southwest (map). Rocky Mountain Forest and Range Experiment Station, USDA Forest Service (scale 1:1,000,000).
- Fuller, Doug. 1985. U.S. Cactus and Succulent Business Moves Toward Propagation. TRAFFIC (U.S.A.) 6(2):1-11.
- McClymonds, N.E. 1957. Stratigraphy and structure of the Waterman Mountains, Arizona. M.S. Thesis, University of Arizona, Tucson. 150 pp.
- Phillips, A.M., III, B.G. Phillips, L.T. Green, J. Mazzoni, and E.M. Peterson. 1979. Status report for Echinocactus horizonthalonius Lemaire, var. nicholii L. Benson, prepared for U.S. Fish and Wildlife Service, Albuquerque, NM
- Sellers, W.O. and R.H. Hill. 1974. Arizona Climate 1931 - 1942. The University of Arizona Press, Tucson, AZ.
- Weniger, D. 1970. Cacti of the Southwest. University of Texas Press, Austin and London.
- Yatskievych, G. and P.C. Fischer. 1984. New plant records from the Sonoran Desert. Desert Plants 5(4):180-185.

PART III

IMPLEMENTATION SCHEDULE

The Implementation Schedule that follows is a summary of scheduled actions and costs for the Nichol Turk's head cactus recovery program. It is a guide to meet the objectives of the recovery plan for the cactus, as elaborated upon in Part II, Narrative. This schedule indicates the general category for implementation (I = information gathering, M = management, A = acquisition, O = other), recovery plan tasks, corresponding action outline numbers, task priorities, duration of the tasks ("ongoing" means that once the task is begun it will be conducted on an annual basis), the agencies responsible to perform these tasks, and the estimated costs for FWS tasks. Part III is the action of the recovery plan, that when accomplished, should bring about the recovery of the endangered Nichol Turk's head cactus and protection of its habitat. It should be noted that monetary needs for agencies other than FWS are not identified and therefore Part III does not reflect the total financial requirements for the recovery of the species.

General Categories for Implementation Schedules

Information Gathering - I or R (research)

1. Population status
2. Habitat status
3. Habitat requirements
4. Management techniques
5. Taxonomic studies
6. Demographic studies
7. Propagation
8. Migration
9. Predation
10. Competition
11. Disease
12. Environmental contaminant

Management - M

1. Propagation
2. Reintroduction
3. Habitat maintenance and manipulation
4. Predator and competitor control
5. Depredation control
6. Disease control
7. Other management

Acquisition - A

1. Lease
2. Easement
3. Management agreement
4. Exchange
5. Withdrawal
6. Fee title
7. Other

Other - O

1. Information & education
2. Law enforcement
3. Regulations
4. Administration

Recovery Action Priorities

- 1 = An action that must be taken to prevent extinction or to prevent the species from declining irreversibly.
- 2 = An action that must be taken to prevent a significant decline in species population/habitat quality, or some other significant negative impact short of extinction.
- 3 = All other actions necessary to provide for full recovery of the species.

Abbreviations Used

BLM - USDI Bureau of Land Management
 FWS - USDI Fish and Wildlife Service
 ES - Division of Ecological Services
 SE - Office of Endangered Species
 LE - Division of Law Enforcement
 RE - Division of Realty
 BIA - Bureau of Indian Affairs
 PIR - Papago Indian Reservation
 AZ - State of Arizona

IMPLEMENTATION SCHEDULE

GENERAL PLAN TASK CATEGORY	TASK #	PRIORITY #	TASK DURATION	RESPONSIBLE AGENCY		FISCAL YEAR COSTS COMMENTS (EST.)*			
				FWS	OTHER	FY 1	FY 2	FY 3	
									REGION PROGRAM
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	
M2	Enforce existing regulations	111 112 113	1	ongoing	2	SE LE ES	5,000	5,000	5,000
M3	Withdraw suitable habitat from operation of mining laws	121	1	1 year		BLM			
M1	Monitor populations and habitat on BLM lands	122	2	ongoing	2	SE	5,000	5,000	5,000
M3	Consolidate Federal ownership of habitat in Waterman Mountains	123	2			BLM			
M3	Develop ORV designation	124	1	1 year		BLM			
M7	Designate ACEC	125	2	1 year		BLM			
M7	Prohibit surface occupancy and removal of saleable minerals in Waterman Mountains	126	1	1 year		BLM			

*Costs refer to USFWS expenditures only.
Task duration is in years.

IMPLEMENTATION SCHEDULE (continued)

GENERAL CATEGORY	PLAN TASK	TASK #	PRIORITY	# TASK DURATION	RESPONSIBLE AGENCY		FISCAL YEAR COSTS COMMENTS (EST.)*		
					FWS	OTHER	FY 1	FY 2	FY 3
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	
R1	Survey and monitor populations and habitat on State and BIA lands	127	2	ongoing	2	SE BIA PIR	5,000	5,000	5,000
M7	Seek cooperation of BIA	128	1	1 year	2	SE BIA PIR			
R1	Survey and monitor populations and habitat on State of Arizona lands	131	2	ongoing	2	SE AZ	5,000	5,000	5,000
03	Determine State of Arizona Land Department responsibilities on leased lands	132	2	1 year		AZ			
M7	Seek cooperation of State of Arizona	133	3	1 year	2	SE AZ	1,000		
R1	Survey and monitor populations on private lands	141	2	ongoing	2	SE	5,000	5,000	5,000
M7	Seek cooperation of private landowners	142	3	1 year	2	SE RE	1,000		

*Costs refer to USFWS expenditures only.

IMPLEMENTATION SCHEDULE (continued)

GENERAL PLAN TASK CATEGORY	(1)	(2)	(3)	(4)	(5)	RESPONSIBLE AGENCY	FISCAL YEAR COSTS COMMENTS (EST.)*					
							TASK #	PRIORITY	# TASK DURATION	OTHER		
										FWS	FY 1	FY 2
R3		Study ecological requirements	21	2	3-5 years	SE	10,000	10,000	10,000	10,000		
R1		Study population biology	22	2	3-5 years	SE	10,000	10,000	10,000	10,000		
R6		Search suitable habitat	23	2	3 years	SE	10,000	10,000	10,000	10,000		
I1		Develop a cactus trade management plan	31 32 33 34	3	1 year	SE LE	20,000					
R14		Develop public awareness	4	3	ongoing	SE	5,000	1,000	1,000	1,000		

*Costs refer to USFWS expenditures only.
Task duration is in years.

APPENDIX I

SUMMARY OF CLAY MAY'S RESEARCH

A study of the dynamics of a population depends heavily on the ability to age individuals. In this study, age was determined by clipping the spines off of one apical areole and noting the number of new areoles (spine groups) emerging from that rib each year. Four years of observations demonstrate that both juvenile and adult plants develop one new areole per year. Seedlings are more variable in growth rate, with two of three areoles emerging per year. Seedling and juvenile plants are easily recognized by spine morphology. Seedlings have thin spines that are almost round in cross section and they lack a central spine. Juvenile plants, on the other hand, possess spines that are adult-like but are smaller and they possess a central spine. The age of the juvenile and adult plants was calculated by counting the number of areoles from the apex to the tap root and noting the first areole with enlarged adult spines. This method provided an estimated age with an error of plus or minus one year.

Age structure has been determined for three populations in the Waterman Mountains (Table 1). These three populations may be ranked according to their age structure with

population 2 being the youngest (mean age of 9.5 years), population 1 being intermediate in age (mean age of 12.0 years), and population 3 being the oldest (mean age of 13.0 + years).

Table 1. Age structure of Echinocactus horizonthalonius var. nicholii populations in the Waterman Mountains, Pima County, Arizona.

Population structure by spine morphology and number	Percent of Population		
	<u>1</u>	<u>2</u>	<u>3</u>
Seedling	1.5	1.0	4.5
Juvenile	1.0	6.0	17.5
1-8	48.5	75.0	29.5
8-10	10.5	10.0	15.0
11-15	19.0	4.0	18.5
16-20	13.5	4.0	6.0
21-28	3.0	0	6.0
29+	3.0	0	3.0
Mean age (years)	<u>12.0</u>	<u>9.5</u>	<u>13.0+</u>

Data ex. 1981 Census

The onset of sexual maturity (flowering) occurs when the plants are 7 years old. Plants flowering for the first time produce one flower (rarely two), but will produce 3 to 4 flowers by the time they reach 10 years of age. Maximum observed age in the sample populations ranged from 24 years (population 2) to 39 years (population 3), but plants as old as 63 years have been found.

Probability plots for the three study populations indicate a multimodal distribution for age in each population. Population 2 has a less complex age structure than the other populations studied. In each of the three cases, a near normal distribution was observed in the spine count range from 1 - 7. Plants in this group are classified as "young" plants. A ratio of young plants to old plants also follows the inferred age rankings with population 2 being composed of 80% young plants, population 1 with 52% young plants, and population 3 with 58% young plants.

Size of the plants (volume) does not necessarily indicate age of the plant, but is a reflection of site quality. That is, plants of the same age (spine number) will vary greatly in their volume depending on their location. Using an index of volume/age for any particular plant and its nearest neighbors demonstrated that large plants tend to be

associated with large neighbors rather than small ones, which suggests that the site is indeed a controlling factor of plant size.

Distribution of sessile organisms has substantial effects on population structure, reproductive biology, replacement, and establishment rates of the population. Thus, distribution is as important a biological attribute as are recruitment-mortality rates and age structure of that population. In this study, quadrat methods were not used as they necessarily suffer the grave disadvantage of being arbitrary. Instead, a plotless method (nearest neighbor) was employed to sample the natural pattern based on distance sampling techniques. Marking plants in the three sites began at the approximate geometric center of each population and progressed by marking nearest neighbors until 75+ plants were marked and/or until the running mean (r critical) was exceeded (see discussion below). The nearest neighbor method of Clark and Evans (1954) was used to test for deviations from randomness. This method assumes the following: 1) density (p) of the species is known, and 2) marked individuals stay put while measurements are taken. Essentially the method is: observed mean distance between a plant and its nearest neighbor is r (which is the summation of r/N), where r is the distance and N is the number of observations. The expected value is $E(r)$, which equals $[1/2 (p-1/2)]$, where p is the number of plants

per unit area. The ratio, R of expected value to observed value, is R (which equals $r/E(r)$). When $R = 1$, then a random distribution is indicated, but as R approaches 0, clumped distribution is indicated. When R is greater than 1, the population has a regular distribution pattern. To test the significance of a deviation from the expected value of R , a standardized normal variate, z , is used as $z = (r - E(r))/S.E.$, where $S.E. (r) = 0.26136/(Np)^{1/2}$.

Maps of each sample population were constructed using the method of least-squares mapping using interpoint (plant) distances (Rohlf and Archie 1978). From these maps, the degree of distribution, biological aspects of site quality, and other biological attributes of the population related to interplant distances may be calculated and tested. More importantly, however, various sampling methods may be tested and applied to other populations with considerable savings in time and effort.

Flowering of E. horizontalonius var. nicholii is sporadic throughout the warmer months of the year with the bulk of the flowering (about 90%) occurring during the summer drought in June. The flowers last only one day and these cacti are one of the few plants to flower at this time. The flower is red-pink, which contrasts sharply with the otherwise predominantly yellow flower spectrum in the habitat. This rare color morph produces a high pollinator fidelity.

Tests in the summer of 1978 using pollinator exclusion, emasculation plus self-pollination, demonstrated that this species is self-incompatible (= outcrossing). Each "test" plant was within 0.25 m of a "control" plant of about the same size that flowered on the same day, producing paired observations for statistical testing (t-test for paired comparisons, p less than 0.001).

Bees of the size range of 1.5 cm to 5.0 cm are the most prominent visitors to the flowers of this cactus. The most abundant bee is presumed to be of the genus Centris, but other bees such as Apis mellifera and digger bees were commonly observed. A small (5 mm) cuckoo wasp also commonly visited flowers of this plant. The flowers were visited by a host of other insects ranging in size from Thysanurans to flower beetles, various flies and wasps up to butterflies of the family Pieridae.

Newly dehisced fruits have been found from August to January. Dehisced fruit will drop 1/2 to 2/3 of its seed crop and leave the remaining seed "in storage" in the wool-covered apical pit. With the onset of flowering during the following year, seeds "in storage" will be ejected by the elongation of the flower. It is apparently this proportion of the seed crop that produces most of the replacement plants as the summer rains (which deliver high soil moisture at high

soil temperatures) shortly follow the flowering period. This coupling of winter (plant hydration) and summer (seed germination--survival) climatic events in the Sonoran Desert determines this plant's successful reproduction in the desert setting.

Lateral branching ("pupping") or ramet production in E. horizontalonius var. nicholii is rare and has been observed only when the apical meristem is injured. Although this cactus primarily occurs as a single stem, clumps of two or more stems are common. Usually clumps of this cactus are dominated by one large stem. Origins of clumps become immediately clear once seedling establishment is considered. Most seedlings and juvenile plants are found at the base of the parent plant due to two factors. First, the immediate region of the cactus receives the greatest seed rain; and second, the larger plants provide safe sites for seedling establishment. In fact, most seedlings are found on the north-facing side of the parent plant. Seedling establishment away from the parent is rare and is probably strongly dependent on the number and distance of safe sites (sensu Harper 1977). As an example, population 3 is located on a terrace characterized by highly fragmented limestone outcrops and rubble-covered surface. This population produces more non-associated seedlings than populations 1 and 2, which are

characterized by a gravel-soil mixture lacking the more frequent emergent rocks found in population 3. This fact implies that there are more safe sites at locality 3. Death of the original plant will leave a safe site for seed originating either from itself or its progeny; hence, clumps are generally long-lived with individual plants replacing each other at the same site over many years.

Literature Cited

- Clarke, P.J. and F.C. Evans. 1954. Distance to nearest neighbor as a measure of spatial relationships in populations. *Ecology* 35:445-453.
- Harper, J.L. 1977. *Population Biology of Plants*. Academic Press, New York, N.Y.
- Rohlf, F.J. and J.W. Archie. 1978. Least squares mapping using interpoint distances. *Ecology* 59(1):126-132.

APPENDIX II

List of Reviewers

An agency draft of the Nichol Turk's Head Cactus Recovery Plan was sent to the following agencies and individuals for their review on October 9, 1985.

Mr. Reggie Fletcher
U.S. Forest Service
Albuquerque, NM

Dr. Edward F. Anderson
Whitman College
Walla Walla, Washington

Dr. Arthur Phillips, III
Dr. Barbara Phillips
Museum of Northern Arizona
Flagstaff, Arizona

Mr. Clay May
Tucson, Arizona

Dr. Thomas R. Van Devender
Arizona Sonora Desert Museum
Tucson, Arizona

Mr. Andy Laurenzi
The Arizona Nature Conservancy
Tucson, Arizona

Ms. Mary Butterwick
Bureau of Land Management
Phoenix, Arizona

Dr. Donald Pinkava
Arizona State University
Tempe, Arizona

Mr. Peter S. Bennett
National Park Service
Tucson, Arizona

Mr. Steven Brack
Belen, New Mexico

Mr. Mark Dimmitt
Arizona Sonora Desert Museum
Tucson, Arizona

Dr. Francis R. Thibodeau
The Center for Plant Conservation
Arnold Arboretum
Jamaica Plain, Massachusetts

Area Director
Bureau of Indian Affairs
Phoenix, Arizona

Mr. Ivan J. Shields
Arizona Commission of
Agriculture and Horticulture
Phoenix, Arizona

Special Agent
Law Enforcement
USFWS, Region 2

State Director
Bureau of Land Management
Phoenix, Arizona

Field Supervisor, ES
Phoenix Field Office
USFWS, Region 2

Comments Received

Letters of comment on this plan have been reproduced in this section and are followed by the responses made to each comment.



United States Department of the Interior

BUREAU OF LAND MANAGEMENT

Phoenix District Office
2015 West Deer Valley Road
Phoenix, Arizona 85027

December 6, 1985

Mr. Dave Langowski
U.S. Fish and Wildlife Service
P. O. Box 1306
Albuquerque, New Mexico 84103

Dear Mr. Langowski:

In response to your letter of October 9, 1985 the district botanist has reviewed the agency review draft recovery plan for *Echinocactus horizionthalonius* var. *nicholii* and offers the following comments for your consideration.

- A-1 Page 3 - Distribution Paragraph 2 - As written this statement implies a continuous distribution from the Vekol Mts. to the Waterman Mts. and south to the Sierra del Viejo. The disjunct nature of the species' distribution should be clearly stated.
- A-2 Page 8 - Mining - An air strip and a millsite was constructed on BLM land. Harlow Jones, with Happy Jack Mine, has expressed an interest in developing his unpatented claims but has not yet submitted a Notice of Intent or a Mining Plan of Operation regarding additional mining activity.
- A-3 Page 9 - Mining - A portion of the Vekol Mountains population occurs on patented land and therefore receives no legal protection.
- A-4 Page 10 - Collecting - *E. h. var. nicholii* is listed on page 91 of the Traffic (U.S.A.) publication International Trade in Plants. Although no plants were reported in trade between 1977 and 1979, the effect of trade on rarity is classified as heavy and field collected plants is the major source of the plant in commerce.
- A-5 Page 10 - Other Factors - An increase in stocking rates, construction of water developments or imprinting could impact the species. An allotment management plan (AMP) for the Waterman Peak Allotment will be written in the next two years. The conservation of Nichol Turk's Head cactus should be considered in the development of this AMP. Livestock utilization is not expected to increase in the Waterman Mountains.

Ind. Sp. R-2	
JOHNSON	<input checked="" type="checkbox"/>
Bowman	<input type="checkbox"/>
Burton	<input type="checkbox"/>
Conley	<input type="checkbox"/>
Halverson	<input type="checkbox"/>
Malinin	<input type="checkbox"/>
Lewis	<input type="checkbox"/>
McDonnell	<input type="checkbox"/>
Orin	<input checked="" type="checkbox"/>
Stafford	<input type="checkbox"/>
Stout	<input type="checkbox"/>
PADILLA	<input type="checkbox"/>
Harp	<input type="checkbox"/>
Hopp	<input type="checkbox"/>
SANCHEZ	<input type="checkbox"/>
FILE	<input type="checkbox"/>

return → PD

FWS REG 2
RECEIVED

DEC 11 '85

SE

A-6 Page 12 - Monitoring Efforts, Paragraph 2 - change 2100 acres of public land to 2365 acres. BLM will not manage the 590 acres of state land until BLM acquires this parcel. In the draft habitat management plan for this species about 550 acres of patented land are identified for acquisition as well.

A-7 Page 13 - The Prime Objective and the criterion for downlisting are well stated. Protection of a percentage of known habitat is a more meaningful goal at this point than the protection of an arbitrary number of plants.

A-8 Page 15 - 125 - Within the next two years ORV designations will be made for the entire Phoenix Resource Area, including the Waterman Mountains. Area-wide designations should not attract as much public attention to the Waterman Mountains area as a separate ORV designation would.

A-9 Page 15 - 126 - An ACEC designation may not be the best method for conserving *E. h. var. nicholii* for the designation process will draw the public's attention to the area. An approved and implemented HMP may be just as effective.

A-10 Page 21 - 124 - Acquisition of patented land by BLM or a private conservation organization is another option that should be considered.

A-11 Page 36 - Implementation Schedule - The asterisk after Fiscal Year Costs needs to be defined. It should be clear that the costs listed are only those of the Service.

A-12 For Task 113, should ES be SE?

A-13 For Task 128, omit the work 'state.'

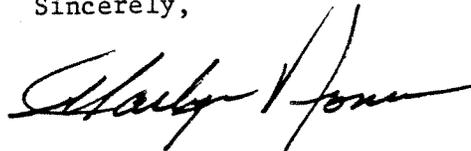
A-14 Who will be responsible for the inventory of populations in Mexico?

A-15 Page 37 - Task 142 - What does RE refer to?

Many of the recovery actions assigned to BIA will require the cooperation of the Papago Indian Tribe for successful implementation.

The plan is well written and when approved will serve as a valuable guide for conservation efforts for *E. h. var. nicholii*. Thank you for the opportunity to comment on this draft recovery plan.

Sincerely,



Marlyn V. Jones
District Manager



United States Department of the Interior

BUREAU OF LAND MANAGEMENT ARIZONA STATE OFFICE

3707 N. 7th Street
P.O. Box 16563
Phoenix, Arizona 85011

6840 (932)

December 4, 1985

Memorandum

To: Regional Director, Region 2, Fish & Wildlife Service, Albuquerque,
New Mexico

From: Deputy State Director, Lands & Renewable Resources, Arizona

Subject: Draft Recovery Plan for Nichol Turk's Head Cactus

End Sp. R-2
✓ JOHNSON
LANGOWSKI
Bowman
Burton
Carley
Halvorson
Hoffman
Lewis
McDonald
✓ Otwell
Stiefferud
Stout
PADILLA
Harp
Hopp
SANCHEZ
FILE

We have reviewed the Draft Recovery Plan for Echinocactus horizontalonius
var. nicholii and provide the attached comments.

Herman Kurt
Acting

Attachment

FWS REG 2
RECEIVED

DEC 6 '85

SE

General Comments

The Draft Recovery Plan appears to be very comprehensive and adequate to at least meet downlisting requirements for the species and also possible delisting efforts.

Specific Comments

- B-1 p.3 Second paragraph. Since the research publication states that only a single plant was discovered, this single plant cannot be distributed over a few limestone ridgetops. Is the plant's potential habitat or known habitat restricted to a few limestone ridgetops?
- B-2 p.8 1. Mining. First paragraph. Is there a threat from natural erosion, or only from man-induced erosion resulting from road development.
- How severe is this impact? How many plants were destroyed and what percent of the population is affected? How extensive is this impact on the total habitat of the cactus?
- B-3 pp.8, 9 1. Mining. Can the Fish and Wildlife Service reference existing documentation which verifies that this type of dust coating significantly reduces plant growth and lowers reproductive rate on cactus?
- B-4 p.13 Recovery. Second paragraph, first sentence. Is there only one criterion, protection of 75% of the known habitat, needed for downlisting? Isn't a stable or increasing population also a prime criterion?
- B-5 Second paragraph, second sentence. Is attainment referring to the protection of 75% of the known habitat?
- p.19 No. 113. There appears to be some contradiction concerning compliance with 3809 Surface Management regulations and the need for mineral withdrawal of suitable habitat on page 20 (No. 121).
- B-6 The narrative indicates that if adequate compliance with 3809 regulations is established then adverse impacts to the species or its habitat would be prevented. Since BLM's requirements under the ESA would be met and consultation through section 7 would guarantee continued compliance, then a mineral withdrawal does not seem justified.
- B-7 p.20 121. Clarification is needed on what FWS has determined to be suitable habitat. It would appear that the Bureau would be the agency determining what habitat occupied by Nichol Turk's Head cactus is suitable for mineral withdrawal. It would be extremely difficult for BLM at this time to identify and provide substantive data to support mineral withdrawal of specific habitat areas.

A specific request and documentation from FWS which substantiates an adverse impact to Nichol Turk's Head cactus would provide adequate support for the Bureau to proceed with such a proposal.

p.20

B-8

No. 122. It is also recommended by the recovery plan that the validity of inactive mining claims be determined and added to the withdrawal area. Any withdrawal should include the "entire area" determined suitable by BLM. This should include areas both with and without mining claims, if appropriate. A withdrawal does not have to await completion of validity determinations, although prior existing rights would be recognized. It should be noted that the rights of mining claimant has the right of appeal to any contest charges initiated against a mining claim. A hearing and decision by an Administrative Law Judge may be rendered in favor of the mining claimant. This process is time consuming for BLM and may take several years. It, therefore, appears more appropriate to consider greater enforcement of the 3809 regulations to control impacts to the Nichol Turk's Head cactus and compliance with the Endangered Species Act of 1973.

p.22

No. 126. We believe that the development of a habitat management Plan (HMP) may provide a more cooperative framework for management of this habitat than an ACEC designation. It is possible that this designation (ACEC) could attract additional visitors to the area which could increase the impacts to the cactus and its habitat.

B-9

The master MOU between the FWS and BLM recognizes the HMP as the primary activity plan to effectively manage threatened and endangered species and their habitat on public lands. Present policy within BLM requires that an HMP be prepared for all federally listed species which have an approved recovery plan.

B-10

The HMP protects the species as effectively as an ACEC. The ACEC itself does not afford the species any additional protection than the ESA which requires that the BLM, through its actions and/or decisions, will not jeopardize the continued existence of any federally listed species.

The ACEC requires a more extensive planning process with considerable more time needed and would delay the implementation of special management consideration for the species and its habitat. The ACEC designation, with its accompanying ACEC management plan, would result in a major modification of the Resource Management Plan (RMP) as well as an EIS.

B-11

If the ACEC designation is used, the procedures for ACEC designation require publication in the Federal Register of the legal description of the habitat and the reasons for the designation. This act plus public meetings would unnecessarily draw attention to the cactus and could be very counterproductive for the protection of the species.

- B-12 p.24 No. 133. ANPL is an uncommon acronym and should be referenced on page 11, or probably written out in full on this page.
- B-13 p.26 No. 211. Has FWS contemplated an experimental transplant on these seemingly identical areas that have no cacti?
- B-14 Implementation Schedule, first page
Under Responsible Agency, is FS a typographical error, or an agency not referenced under Abbreviations Used (p.36)?
- Implementation Schedule, second page.
Under Responsible Agency, RE is not referenced under Abbreviations Used (p.37).



THE CENTER FOR PLANT CONSERVATION

125 THE ARBORWAY • JAMAICA PLAIN, MA 02130 • 617 524-6988

29 October, 1985

Peggy Olwell
 United States Dept. of the Interior
 Fish and Wildlife Service
 P.O. Box #1306
 Albuquerque, N.M. 87103

Dear Ms. Olwell:

This letter is in response to the request for comments on the draft recovery plan for Echinocactus horizontalonius var. nicholii; dated 9 October.

We have three major comments, each of a very different nature:

- C-1 1) The recovery plan neither describes the number and size of existing population, nor the number and size necessary for down listing. We believe that it is seldom likely to be better to set a criterion for down listing in terms of acres, rather than protected plants. The comment on page -10- that commercial collecting (without licensing?) may be a serious problem gives added emphasis to this point.
- C-2 2) We would like your office to consider an appropriate off-site component as part of a total recovery plan. First, we believe that much of the required information on ecological optima and reproductive potential could be obtained most easily ex situ. In addition, a permanent well documented and accessible living collection, together with appropriate seed banking, could provide an important source of material for non-destructive research, maintenance of wild populations and public awareness -- all goals of the recovery plan that require living material. It would be regrettable if more than founding stock for these purposes were obtained from the wild. We would be pleased to assist in the design of such a program, if, in fact, it would be of benefit to the species' recovery.
- C-3 3) We applaud most strongly the suggestion that there should be a comprehensive trade management plan for all cacti, and hope that such a sweeping requirement will not make implementation of the remainder of the plan less likely.

We are forwarding a copy of the recovery plan to the Desert Botanical Garden, our participating institution in the region, per your request.

Sincerely,

Francis R. Thibodeau, Ph.D.
 Director of Science

End. Sp. R-2
✓ JOHNSON
✓ LAUGHER
Bowman
Burton
Carley
Halvorson
Hoffman
Lewis
McDonald
Olwell
Stefferd
Stout
PADILLA
Harp
Hopp
SANCHEZ
FILE

FWS REG 2
 RECEIVED

NOV 1 '85

SE

FRT/k1b



gfr

Reply To: 2670

Date: October 28, 1985

File Sp. R-2
<input checked="" type="checkbox"/> JOHNSON
<input checked="" type="checkbox"/> LANGOVSRI
<input type="checkbox"/> Bowman
<input type="checkbox"/> Burton
<input type="checkbox"/> Carley
<input type="checkbox"/> Halverson
<input type="checkbox"/> Hoffman
<input type="checkbox"/> Lewis
<input checked="" type="checkbox"/> McDonald
<input checked="" type="checkbox"/> Olwell
<input type="checkbox"/> Steffrud
<input type="checkbox"/> Stout
<input type="checkbox"/> PADILLA
<input type="checkbox"/> Harp
<input type="checkbox"/> Hopp
<input type="checkbox"/> SANCHEZ
FILE

- RD
 - DRD
 - AA
 - AFF
 - AWP
 - AHR
 - IE
 - PAO
 - EEO
 - FILE
 - Action *SE*
- 6-10-30*

Mr. Michael Spear
Regional Director
USDI, Fish and Wildlife Service
P.O. Box 1306
Albuquerque, NM 87103

Dear Mr. Spear:

I appreciate the opportunity to comment on the agency review draft of the recovery plan for Echinocactus horizontalis var. nicholii. Since this cactus does not occur on National Forest, the following comments were prepared as a member of the Arizona plant recovery team and do not necessarily reflect views of the Forest Service.

D-1

The agency review draft is an excellent document much improved over the technical review draft. For the most part, the plan, if implemented promptly, should provide for the recovery of the cactus and permit downlisting to Threatened within a short period of time.

D-2

If a significant portion of the occupied habitat for this cactus is on private land or if the State should be unable to provide adequate management protection, a program should be initiated to secure uncontrolled sections of the habitat. This can be done several ways including outright purchase of surface and/or mineral rights, and leasing of sites or easements.

D-3

For those locations under Federal control not withdrawn from mineral entry, some provisions may need to be made to control mineral exploration.

D-4

In the Impacts and Threats section, reference is made to damage from milling dust. This is not treated in the step-down Outline or Narrative. Is it possible to control or modify this adverse affect?

D-5

I firmly believe that in addition to studying the problem of illegal collections and black market pressures, we need to proceed immediately with a program that promotes development of a legitimate market for all of our overcollected rare cacti. At the least, we should be able to utilize such a program as an opportunity to develop public awareness, appreciation, and support for the onsite preservation of our rare cactus resource.

D-6

During a conference in Saltillo, Mexico, last February, I had the opportunity to observe results of a pilot project in water spreading in the lower portions of the Chihuahuan desert. Areas of about a quarter of an acre were enclosed with a border raised several inches to control sheet-flow of

FWS REG 2
RECEIVED

OCT 30 '85

SE





Mr. Michael Spear

rainwater. These plots received much more effective precipitation than surrounding undeveloped sites. The protected plots contained numerous young Echinocactus horizonthalonius plants. Similar projects might be suitable for the more level sites on the alluvial fans considered to be suitable habitat for the Nichol Turk's head cactus.

D-7

The extensive studies conducted on this cactus by Clay May have provided us with a much better understanding of the plant than we have for most of our other Threatened and Endangered species. While these studies need to be continued and expanded, Clay's contribution merits the gratitude of all of us who work on various aspects of the Endangered species program.

Sincerely,

A handwritten signature in cursive script that reads "Reggie Fletcher".

REGGIE FLETCHER
Regional Botanist





Whitman College

Walla Walla, Washington 99362

Division III: Basic Sciences & Mathematics
(509) 527-8225

LANCASHIRE	
Bowman	
Burton	
Carley	
H. Johnson	
Holzer	
Lewis	
McDonald	
Miller	
Stallion	
Smith	
PADILLA	
Harp	
Hopp	
SANCHEZ	
FILE	

14 October 1985

Chief, Endangered Species
Fish and Wildlife Service
U.S. Department of the Interior
P.O. Box 1306
Albuquerque, NM 87103

Dear Sir:

I have read the draft recovery plan for Echinocactus horizontalis
var. nicholii, which I received in the mail last week.

E-1

This plan is both well-conceived and well-written. I can find no
fault with it and the plan seems to address all of the major problems
connected with the proposed recovery of this variety of cactus.

Sincerely,

Edward F. Anderson
Professor and Chairman
Department of Biology

FWS REG 2
RECEIVED

OCT 21 '85

SE

- A-1 Recommendation was incorporated into plan.
- A-2 Comment noted.
- A-3 Comment incorporated.
- A-4 Appropriate changes made.
- A-5 Comments included.
- A-6 Comments incorporated.
- A-7 Comment noted.
- A-8 FWS hopes that BLM will consider an area-wide ORV designation for Nichol Turk's head cactus habitat in developing their Resource Management Plan.
- A-9 FWS agrees that an approved and implemented HMP may be just as effective as an ACEC designation. However, until the draft HMP is approved, an ACEC designation is an alternative management tool.
- A-10 Comment noted.
- A-11 Recommendation included.
- A-12 No, ES is Ecological Services who are responsible for Section 7 consultation.
- A-13 Correction made.
- A-14 FWS will be responsible for inventory of Mexican population.
- A-15 RE refers to U.S. Fish and Wildlife Service Realty Office.
- B-1 The determination that E. horizontalonius var. nicholii occurs in Mexico was made using a single herbarium voucher specimen; however, the population that this specimen came from occurs over a few limestone ridgetops.
- B-2 It appears that man-induced erosion resulting from road development is more of a threat than naturally occurring erosion. Plants have been observed eroding out of bladed roadcuts; however, this has not been quantified. Monitoring efforts are necessary to determine the extent of this and other threats to the species.

- B-3 No study has been conducted to test the hypothesis that this dust coating may significantly reduce plant growth; however, it is a potential threat to the species and should be monitored.
- B-4 Presently, we have a much better estimate of the habitat of this plant than of the actual numbers of plants that exist. The stability of the population is a major concern and with the establishment of monitoring plots we will be able to monitor the population stability. This data will play an important role in the decision to downlist or delist.
- B-5 Yes, attainment is referring to protection of 75% of known habitat.
- B-6 The Service believes a mineral withdrawal is justified for Nichol Turk's head cactus and its habitat in addition to compliance with 3809 surface management regulations and with Section 7 of the ESA. It is important to look at the cumulative impacts of mineral operations on the species and its habitat. Compliance with Section 7 of ESA prevents jeopardy but does not assure conservation of the species. Compliance with the 3809 regulations also does not assure conservation of the species. BLM does not require an environmental assessment on Notification of Intent (NOI); therefore, no survey inventory of land is done for threatened or endangered plant species when an NOI is submitted. The continued degradation of the habitat from mineral development is indeed a threat to Nichol Turk's head cactus.
- B-7 BLM is the agency determining what Nichol Turk's head cactus habitat is suitable for withdrawal. The suitable habitat has been delineated by BLM in the draft Nichol Turk's Head Cactus Habitat Management Plan and specific habitat areas suitable for withdrawal have also been delineated. The Section 7 consultation files for Nichol Turk's head cactus on BLM lands should provide the documentation which substantiates an adverse impact from mining on the species. The construction of an airstrip on Happy Jack Mine destroyed approximately 50 acres of habitat and 350 individual plants.
- B-8 The Service agrees with BLM that "any withdrawal should include the 'entire area' determined suitable by BLM." Task 122 was deleted from the recovery plan and a statement concerning relinquished claims was incorporated under Task 121.

- B-9 The Service is pleased to see BLM using the HMP as a management tool for threatened and endangered plant species and would support the approval and implementation of the draft HMP for Nichol Turk's head cactus. It is a well planned document which will provide for the conservation of the species and its habitat.
- B-10 It is the Service's understanding that an ACEC can be as restrictive as management wishes it to be and in some circumstances can be a single use area. This type of management tool could be very effective in the management of threatened and endangered plant species whereby those values critical for the protection and conservation of the species could be defined and implemented.
- B-11 The Phoenix Resource Area (PRA) of the BLM is currently developing a Resource Management Plan (RMP) and an ACEC designation could be put into the RMP easily at this time. The ACEC designation may not be as effective a management tool as the HMP but until there is an approved HMP, an ACEC designation is an alternative management tool.
- B-12 Recommendation incorporated into plan.
- B-13 The Service has not contemplated an experimental transplant at this time because we need more basic biological and ecological data on the species before we attempt transplanting.
- B-14 ES is Ecological Services and RE is the Realty division of U.S. Fish and Wildlife Service.
- C-1 The recovery plan does not state the number and size of existing populations because we have incomplete data on numbers and areal extent of populations. Accomplishment of several tasks in this recovery plan will provide this type of data. When that data is available, more fully defined downlisting criteria can be evaluated and delisting criteria can be established.
- C-2 The Service agrees that biological and ecological data can be obtained from ex situ living material and the Service anticipates coordinating with the Desert Botanical Garden on the program.
- C-3 With the cooperative efforts of other Federal land managing agencies, the State of Arizona, the Papago Indian tribe, and other interested parties, the Service hopes to accomplish many of the tasks outlined in this recovery plan; however, the funding of these tasks are contingent upon appropriations and priorities.

- D-1 Comment noted.
- D-2 Tasks 13 and 14 address the issue of managing and protecting the populations on State and private lands. An inventory of these lands is necessary to determine the extent of the populations. After the field survey is completed, we will be able to determine the best protective measures for the populations on those lands.
- D-3 The Bureau of Land Management has drafted an HMP for Nichol Turk's head cactus which addresses the mining threat and mineral withdrawal.
- D-4 It was assumed that this would be part of the design of the BLM monitoring study; nonetheless, Task 122 has been changed to include the determination of the effects of the milling dust on Nichol Turk's head cactus.
- D-5 It is the intention of the Service to develop a Cactus Trade Management Plan (CTMP) for all listed cacti. This CTMP will include a study to determine the feasibility of reducing the collecting pressure on the wild populations by promoting a commercial artificial propagation program. It is also the intent of the Service to work with interested groups to educate the public on threatened and endangered plant species and their habitats.
- D-6 If it is determined that reintroduction is a necessity for the recovery of the species, this information will be considered as a possible technique of habitat manipulation.
- D-7 The Service agrees that Clay May has provided invaluable data on this and other threatened and endangered plant species. We greatly appreciate Clay's efforts and intend to work cooperatively with him in the future.
- E-1 Comment noted.