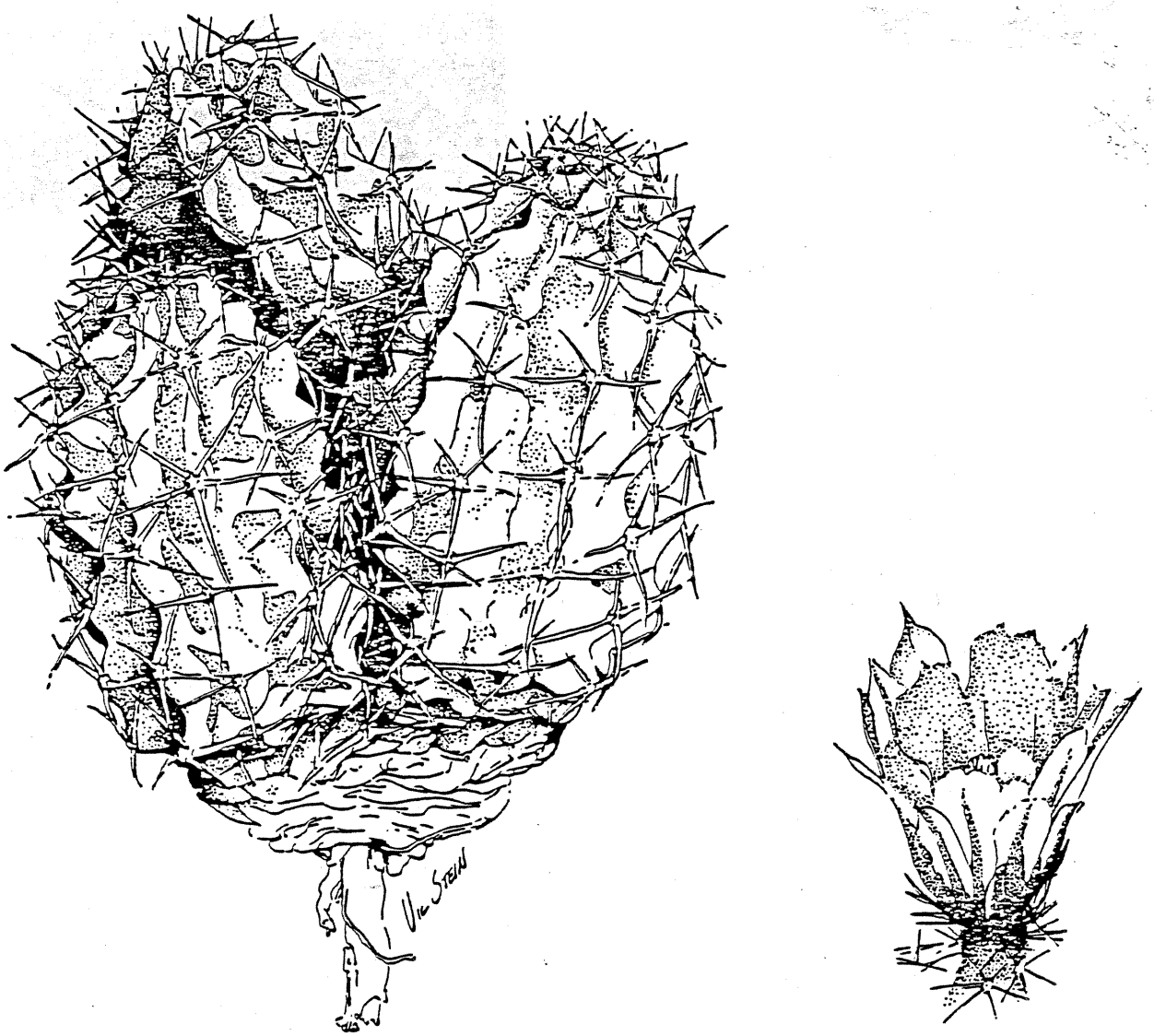
KUENZLER HEDGEHOG CACTUS

(Echinocereus fendleri var. kuenzleri)

RECOVERY PLAN



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RECOVERY PLAN FOR THE KUENZLER HEDGEHOG CACTUS

Echinocereus fendleri Englemann var. *kuenzleri*

(Castetter, Pierce et Schwerin) L. Benson

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Date: 3/29/85

DISCLAIMER

This is the completed Kuenzler Hedgehog 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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SUMMARY

1. GOAL: To remove Echinocereus fendleri var. kuenzleri from the Federal list of endangered and threatened species by managing and protecting the existing populations and by increasing the numbers of the taxon in existing and reestablished populations.

2. RECOVERY CRITERIA: Criteria for the downlisting of Kuenzler hedgehog cactus include the protection, maintenance, and enhancement of existing natural populations; an increase in the numbers of the cactus to approximately 5000 individuals and maintenance of that population level for a period of 5 consecutive years. These criteria would include the management of the habitat and the establishment of a program to curtail collecting through enforcement and through a commercial artificial propagation program. Because of the small range and naturally limited habitat of this cactus, a review of its status will be made once downlisting criteria have been met, to determine delisting requirements.

3. ACTION NEEDED: Major steps needed to meet the recovery criteria include: develop management plans for populations; protect habitat on private lands; develop and implement habitat management plans; monitor populations and identify law enforcement tasks to reduce collection; enforce existing taking prohibitions; study the need to develop artificial propagation programs; and develop a comprehensive cactus trade management plan.

TABLE OF CONTENTS

		Page
	DISCLAIMER	i
	ACKNOWLEDGEMENTS	ii
	SUMMARY	iii
PART I	INTRODUCTION	1
	Taxonomy	2
	Morphology	3
	Distribution	4
	Habitat	5
	Population Biology	7
	Impacts and Threats	8
	Collection	9
	Road Improvements	10
	Real Estate Development	10
	Livestock Use	10
	Management and Research Efforts	11
PART II	RECOVERY	13
	Step-down Outline	14
	Narrative	19
	Literature Cited	34
PART III	IMPLEMENTATION SCHEDULE	36
APPENDIX		40
	List of Reviewers	40
	Comments Received	41
	Responses to Comments	44

PART I

INTRODUCTION

The Kuenzler hedgehog cactus, Echinocereus fendleri Englemann var. kuenzleri (Castetter, Pierce et Schwerin) L. Benson, was listed as endangered under the name of Echinocereus kuenzleri by the U.S. Fish and Wildlife Service (FWS) under the Endangered Species Act of 1973 on October 26, 1979 (44 FR 61924). The cactus is known in the wild from two locations, with a total of less than 500 individual plants. The entire range occurs in Lincoln, Otero, and Chaves Counties, New Mexico. Collecting for private and commercial use is the major threat to the continued existence of this taxon; however, road improvement and maintenance, real estate development, and grazing by cattle are additional threats (Castetter, Pierce and Schwerin 1976; Johnston 1976).

The objective of this recovery plan is to outline the necessary steps to recover the Kuenzler hedgehog cactus to the point at which it can be downlisted to threatened status and establish criteria that must be met for the plant to be delisted. Part I of this plan provides background information on the status, history, and characteristics of E. fendleri var. kuenzleri. Part II is an outline of tasks needed to effect recovery. The narrative following this outline provides more detailed information and justification for the measures or actions recommended. Part III, the Implementation Schedule, is a summary of the actions scheduled and discussed in Part II. The schedule indicates the general category for

implementation, recovery plan tasks, corresponding action outline numbers, task priorities, duration of tasks, the agencies that are responsible to perform the tasks, and lastly, the estimated costs for FWS to perform these assigned tasks.

Taxonomy

Echinocereus fenderli var. kuenzleri was first collected in 1961 by Mr. Horst Kuenzler for whom the cactus was named. In 1976, the plant was described and named as Echinocereus kuenzleri (Castetter, Pierce, and Schwerin 1976). Prior to this time, Kuenzler hedgehog cactus was known under the horticultural name Echinocereus pseudohempelii and it was listed in the 1975 plant notice of review (40 FR 27824) as Echinocereus hempelii, now recognized as a Mexican species. By 1979, when it was listed as endangered, several professional botanists studying the taxon had concluded it was properly a variety of E. fendleri. Because Dr. Lyman Benson was to place the entity as a variety of E. fendleri in his forthcoming work, The Cacti of the United States and Canada, publication of the nomenclatural change was deferred. The manuscript was still in press in October 1979 and the cactus was listed as E. kuenzleri. Benson's work was published in 1982. The name E. fendleri var. kuenzleri is now acceptable according to the International Code of Botanical Nomenclature and has been changed in the July 1984 list of Endangered and Threatened Wildlife and Plants.

Britton and Rose, in their 1920 publication The Cactaceae, noted the E. fendleri complex as having "spines very variable as to color, length, and form." Using Benson's (1982) concept of the species, there are three varieties of E. fendleri. Echinocereus fendleri var. rectispinus is the easiest to differentiate. It has a straight central spine projecting perpendicular to the stem, and radial spines that are straight. Echinocereus fendleri var. fendleri has a central spine that curves upward its entire length and radial spines that are supposed to be straight. Variety kuenzleri has a central spine only rarely and curved lower radials, and is reported to be geographically isolated from the other varieties by approximately 31 km (20 miles). Echinocereus fendleri var. fendleri populations in the Zuni and Sandia Mountains are much like the Kuenzler hedgehog cactus. Echinocereus fendleri var. kuenzleri, as presently known does not appear to merit species status. Further study of its relationship to E. fendleri var. fendleri is required to clarify the genetic relationship as var. kuenzleri has been too rare to allow needed morphological and genetic studies.

Morphology

Kuenzler hedgehog cactus may be single-stemmed or branched (See cover illustration). When branched, the stems are usually less than four but may number as many as eight. The stems are normally short-conical, about 15 cm (6 inches) long and 10 cm (4 inches) wide and consist of 9 to 12 prominent flabby ribs with prominent tubercles from which the spine clusters orginate (Castetter, Pierce, and Schwerin 1976).

The spines are angular in cross section, bulbous, and fused at the base. Central spines are usually absent. Radial spines vary from two to six and are variable in size ranging to about 2.5 cm (1 inch) long. The stout spines are best described as contorted but include such variations as curved or recurved, appressed or spreading, twisted or straight. The spines are white, soft, and chalky in texture with the topmost spine longest (Castetter, Pierce, and Schwerin 1976).

Flowers are apical, about 10 cm (4 inches) long and magenta. Fruits are bright red when mature. They are ovoid to cylindroid, to slightly over 5 cm (2 inches) long and are spiny with miniature versions of the stem spines. Seeds are black and reticulately pitted (Castetter, Pierce, and Schwerin 1976). The few, contorted, white, chalky-textured spines and large, magenta flowers are characters useful in separating the taxon from other cacti within its range.

Distribution

This rare cactus is known from two small population centers in the Rio Hondo and Rio Penasco drainages of Lincoln, Otero, and Chaves Counties, New Mexico. While collecting has almost eradicated this cactus, the overall distribution is probably much as it was when discovered in 1961. Echinocereus fendleri var. kuenzleri appears to be a relatively young taxon rather than an old, relictual taxon. The author has observed that the distribution patterns indicate the taxon is not typical of a

refugial entity that is restricted due to present climatic regimes, but rather is typical of a young taxon with an expanding range (exclusive of anthropogenic factors).

The majority of occupied habitat for this taxon is on private land. A small amount of occupied habitat lies within the boundaries of the Lincoln National Forest with some habitat on State and Bureau of Land Management (BLM) land. A few scattered plants may possibly be found on the Mescalero Apache Indian Reservation.

Habitat

Kuenzler hedgehog cactus is primarily found in the lower fringes of the pinyon-juniper woodland. The dominant overstory is Juniperus monosperma (one-seeded juniper) although the plant may be found high enough to encounter Juniperus deppeana (alligator-bark juniper) and Pinus edulis (Colorado pinyon pine). A partial list of associated species follows this section.

The soils of the preferred habitat are skeletal. The substrate is limestone parent material and mapping units are either Lithic Argiustolls or Lithic Haplustolls for localities on the Lincoln National Forest (Jimmy Gass pers. comm. 1981)*. Further investigation of possible soil specificity is required.

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* Jimmy Gass, Soil Scientist, Regional Office, U.S. Forest Service, Region 3.

The cactus occurs on gentle slopes in the cracks of limestone outcrops or in the shallow soils on the flat steps of hillsides consisting of a step and riser configuration. Overall slopes of the step and riser hillsides can vary from less than 15 to more than 60 percent. The plants themselves appear to require a relatively stable surface on slopes less than 5 percent (Fletcher 1981).

The elevational range is from 1770 to 1950 m (5800 to 6400 feet). The lower reaches of this range contain the most preferred habitat. Minimum winter temperatures are probably the factor limiting establishment near and above 1770 m (5800 ft.). All Kuenzler hedgehog cacti found have been on aspects other than northerly, and a southern exposure appears to be preferred (Fletcher 1981).

A partial listing of species in association with Echinocereus fendleri var. kuenzleri in the lower one-seed juniper (Juniperus monosperma) community follows:

Baccharis pternoides (Yerba-de-pasmo)

Bouteloua gracilis (blue grama)

Eragrostis intermedia (plains lovegrass)

Eriogonum havardii (buckwheat)

Garrya ovata ssp. goldmanii (goldman's silktassel)

Hedeoma pulchella (false pennyroyal)

Juniperus deppeana (alligator barked juniper)

J. monosperma (one-seeded juniper)

Lesquerella valida (bladderpod)

Mammillaria heyderi (pincushion cactus)

Pinus edulis (Colorado pinyon pine)

Salvia earlei (sage)

Population Biology

So few individuals remain in natural habitat that little is known of the population biology of this taxon. The northern center of distribution, discovered in 1978 by J. D. Findley, has been estimated to contain from fewer than 10 plants to about 100 (Isaacs pers. comm. 1978).* It lies entirely on private land and has not been further documented. The southern population center may contain as few as 150 or 200 individuals. Jesse Juen of the Carlsbad District of BLM, in surveying BLM and private lands in the southern area, found approximately 100 individuals in 1982 (Juen 1983). An additional 23 plants were located in other areas by Forest Service personnel in 1980 (Fletcher 1981).

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* William Isaacs, Program Director, New Mexico Natural Heritage Program.

According to the current data, the only populations large enough to allow demographic studies occur on private lands. However, additional survey of State and BLM lands might yield new populations more accessible to study. Surveys on the Lincoln National Forest have yielded mostly isolated individuals at the periphery of the preferred habitat (Bates pers. comm. 1985)*.

Kuenzler hedgehog cactus flowers in late May and fruits ripen in July. Little else is known about the population biology of this taxon; however, it is anticipated that the density of reproductive age plants may be below that necessary for maintenance in all but one or two locations.

Impacts and Threats

While E. fendleri var. kuenzleri has been brought close to extinction in the wild due to collection, no significant amount of suitable habitat has been destroyed by man's activities. However, road improvements and maintenance, real estate development, and grazing by cattle continue to be threats (Castetter, et al, 1976).

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* Jim Bates, Wildlife Biologist, Lincoln National Forest, Region 3, U.S. Forest Service.

Collection

The major threat to the Kuenzler hedgehog cactus is collection. It is not known how many plants have been removed from the wild as there was never an estimate of numbers made prior to collection impacts. However, the total number of plants was probably small when discovered in 1961.

The small number of wild individuals causes any collection to contribute significantly to the reduction of the gene pool. The cactus is on the brink of extinction and known locations are periodically visited by collectors, despite limited legal prohibitions against collection.

Forest Service personnel observed two population sites, from which all E. fendleri var. kuenzleri were removed. Populations at these sites recovered from dormant seed to small, juvenile plants (Fletcher 1981). Once the plants reached a sufficient age to flower, the populations (previously thought to be extirpated), were again taken by collectors. The large magenta flowers are easily seen from as far away as 100 yards. Both of these sites were on either private or State lands and therefore not afforded legal protection from collection or habitat destruction. The 1982 Amendments to the Endangered Species Act prohibit collection from lands under Federal jurisdiction. These include plants that occur on Forest Service and BLM lands. With so few individuals left and collecting a continuing problem, a propagation program to increase the numbers in cultivation and onsite protection must be a high priority.

Road Improvements

The site of the first population discovered is reported to have been destroyed during improvement of US Highway 83 (Castetter, et al 1976). Highway maintenance in the form of mowing and grading since that time has injured or killed some individuals. Herbicide application for roadside weed control may also cause the death of some individual plants (Fletcher 1981).

Real Estate Improvement

Subdivision and development of occupied suitable habitat is a potential threat (Stephens 1979). Presently, however, most real estate development is taking place at more favored, higher elevations in the Sacramento Mountains.

Livestock Use

Any adverse impacts on this cactus by livestock are indirect with the exception of occasional damage due to trampling. The only direct evidence of trampling effects is of a single plant that was stepped on, removing about 1 inch off the top. The plant grew offsets and bloomed 2 years later. Indirect impacts such as removal of grass and increased erosion contribute to seedling mortality (Brack pers. comm. 1981)*

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* Mr. Steve Brack, Cactus Nurseryman, Belen, New Mexico 87002

Exclosure studies are presently being carried out to determine the extent of the adverse effect of livestock use on seedling establishment and adult survival. Occasionally a few plants, their flower buds, and especially fruits are eaten by rodents. Exclosure studies are needed to determine if rodent predation is a significant factor in reduction of the seed bank.

Management and Research Efforts

Previous management and research efforts have involved the development of an Interim Management Plan by the Forest Service in conjunction with FWS personnel (Fletcher 1981). Because the majority of occupied habitat is on private land and so few Kuenzler hedgehog cacti were located on lands within the National Forest System, the Interim Management Plan could not be fully implemented.

Research efforts have been hindered by the inability to find populations large enough for study. In 1983, The Nature Conservancy leased a small parcel of private land near Elk, New Mexico. This parcel contains the largest remaining population and should serve as a site for future studies.

A comprehensive trade management plan for all cacti is necessary to determine the overall trend of trade in listed cacti, to establish what

species are in the trade, to determine the feasibility of reducing the collecting pressure by promoting a commercial artificial propagation program and to develop more effective law enforcement strategies. The FWS policy has not been established concerning the cactus trade problem. With the development of numerous cacti recovery plans, the need for setting FWS policy is crucial for the implementation of these plans.

The recovery of E. fenderli var. kuenzleri cannot be achieved without alleviating the collecting pressure. Enforcement of regulations will deter law abiding citizens but may not reduce black market trade. A possible key to recovery would involve providing propagated Kuenzler hedgehog cactus to the commercial market. Approximately 10,000 individuals each year for a 5-year period may be needed to meet the commercial market demand. With 10,000 individuals in the commercial market each year, it would not be long before the novelty of owning a Kuenzler's hedgehog cactus would diminish. Thereafter, smaller yearly production might be possible.

Concomitant with removal of the collecting pressure, is an estimated goal of 5,000 individuals to be attained and maintained as stable, wild populations.

PART II

RECOVERY

The objective of this recovery plan is to protect and manage E. fendleri var. kuenzleri in order to secure and maintain a wild population level of 5000 individual plants for a period of 5 consecutive years. Once this is accomplished, downlisting to threatened status can be considered. The major strategy for achieving this objective is the establishment of a comprehensive trade management plan for all cacti and the establishment and implementation of FWS policy regarding commercial, artifical propagation for cacti used in trade.

The downlisting of Kuenzler hedgehog cactus is dependent upon the establishment of more than one self-sustaining population and removal of the collecting pressure which can be facilitated by the introduction of 10,000 artificially propagated plants into the commercial market. If FWS policy has not been set by January 1986, or if FWS policy does not allow for the provision of artificially propagated plants into the commercial market, then less cost-effective strategies may have to be implemented, i.e., permanent, onsite law enforcement personnel will have to be provided or other measures will be identified and considered.

Step-down Outline

1. Remove existing and potential threats to E. fendleri var. kuenzleri by enforcement of existing regulations, and management for protection.

    11. Enforce existing regulations.

        111. Enforce existing collecting and trade regulations under ESA, CITES, and New Mexico State laws.

        112. Follow guidelines as set forth by BLM and Forest Service policy to ensure survival of the Kuenzler hedgehog cactus.

    12. Manage existing habitat on public lands.

        121. Develop and implement Forest Service Action Plan and BLM Management Plans.

            1211. Manage off-road vehicle (ORV) use.

            1212. Ensure grazing systems are compatible with species requirements.

            1213. Monitor mineral exploration and other projects.

        122. Coordinate efforts with the State of New Mexico.

1221. Encourage management of State lands and development of a cooperative agreement for protection of the species.

1222. Support State efforts to provide adequate protection for cacti.

13. Manage existing habitat on privately owned lands, cooperatively with landowners.

131. Protect habitat on private lands.

132. Develop and implement habitat management plans for all existing Kuenzler hedgehog cactus habitat on private land.

1321. Regulate land use for the benefit of E. fendleri var. kuenzleri.

1322. Enhance and improve existing habitat.

2. Obtain data to facilitate management decisions to sustain and reestablish healthy populations in their natural habitat.

21. Inventory for E. fendleri var. kuenzleri.

22. Investigate genetic relationships between E. fendleri var. kuenzleri and other varieties of E. fendleri for use in reintroduction activities.

    221. Compare morphological variations.

    222. Make chromosome counts.

    223. Conduct electrophoretic/chromatographic studies.

23. Study environmental parameters.

    231. Soils.

    232. Water and temperature relations.

    233. Slope and aspect preferences.

    234. Investigate biotic relationships.

        2341. Construct exclosures for long term study.

        2342. Seed dispersal.

        2343. Pollinators.

24. Study population biology.

241. Life history characteristics.

242. Demographic trends.

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

31. Develop a trade study.

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

33. Determine feasibility of reducing the collecting pressure on the wild populations by promoting a commercial, artificial propagation program.

34. Develop a Law Enforcement strategy.

4. Investigate propagation techniques and reintroduction methods for E. fendleri var. kuenzleri.

41. Develop improved propagation techniques and reintroduction methods.

42. Reintroduce cultivated plants into depleted suitable habitat within the species' historic range.

43. Consider providing propagated stock to outlets for commercial use.

5. Develop public awareness, appreciation and support for recovery of *E. fendleri* var. *kuenzleri*.

Narrative

1. Remove existing and potential threats to E. fendleri var. kuenzleri by enforcement of existing regulations and management for protection.

If the long-term goal of delisting is to be achieved, all existing populations must be protected by enforcing existing regulations and managed for protection of both plants and suitable habitat.

11. Enforce existing regulations.

Cooperate with the Forest Service, BLM, and the State of New Mexico to enforce existing regulations. Specific law enforcement tasks should be identified and coordinated with FWS Law Enforcement staff. Because Kuenzler cactus is known from only two population centers with less than 500 individual plants, because collection is the major threat to the species and Forest Service personnel have observed complete removal of plants from two sites, and because any collection will contribute significantly to the reduction of the gene pool, enforcement of existing regulations is a priority 1 task to prevent the irreversible decline of the species.

111. Enforce existing collecting and trade regulations under ESA, CITES, and New Mexico State law.

This plant is protected in part by ESA, CITES, and New

Mexico State law. E. fendleri var. kuenzleri is listed as endangered by the Endangered Species Act and is on Appendix II of CITES, which contains species that are not necessarily threatened at present, but which may become so if trade is not strictly regulated.

New Mexico State Law, Chapter 45, Article 8, Section 32, requires an application to sell collected wild plants and Article 11 of that law, Section 1-4, affords limited protection within 400 yards of any highway to all plants (except noxious weeds). "The protection includes limited prohibitions against destruction, mutilation, or removal of living plants (except seeds) on State or private lands, along a highway".

The plant could also be protected under the Lacey Act, as 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. However, New Mexico state law does not meet the necessary protection criteria for the Lacey Act to apply to cactus collected in the state.

112. Follow guidelines as set forth by BLM and Forest Service policy to ensure survival of the Kuenzler hedgehog cactus.

Forest Service and BLM should adhere to their guidelines for management of federally listed species on lands under their administration to ensure compliance with Section 7 of the Endangered Species Act.

12. Manage existing habitat on public lands.

Management of Kuenzler hedgehog cactus habitat on public land should be done through existing agency management procedures.

121. Develop and implement Forest Service Action Plan and BLM Management Plans.

The Forest Service and BLM should develop and implement management plans to ensure full partnership with FWS in the recovery of the species, to coordinate various agency efforts and to establish goals and objectives for future work. With the majority of occupied habitat on private land, adequate protection and management of Federal lands is a major concern to ensure the survival of the species. This priority 1 task would prevent the extinction of the species regardless of what occurs to the habitat on private land where no legal protection for the species exists.

1211. Manage off-road vehicle (ORV) use.

No cross country ORV use should be permitted within the limited range of this taxon. Vehicle traffic should be restricted to existing primitive roads. Signs should be placed as appropriate.

1212. Ensure grazing systems are compatible with species requirements.

Use exclosure studies as in 2341 below to ensure livestock management systems are compatible with seedling establishment and adult survivorship needs. No conflict between seedling establishment, adult survivorship and trampling has been observed, but no comparative studies have as yet been conducted.

1213. Monitor mineral exploration and other projects.

Activities associated with mineral exploration should be sufficiently controlled to assure no jeopardy to the survival of the species. Limestone is the substrate found throughout the range of E. fendleri var. kuenzleri. Because these limestone areas are designated as nonmineralized, they could be withdrawn from mineral entry without resource loss. Road maintenance, transmission line rights-of-way, and recreation also need to be monitored.

122. Coordinate efforts with the State of New Mexico.

Because some habitat of E. fendleri var. kuenzleri exists on State land, coordination between FWS and the State of New Mexico concerning the management of this habitat, and development of a plant cooperative agreement is desirable.

1221. Encourage management of State lands and development of a cooperative agreement for protection of the species.

Proper management of E. fendleri var. kuenzleri on State lands within its range can play a prominent role in its recovery. All efforts toward obtaining management on these lands should be encouraged. Coordination and cooperation between FWS and responsible agencies such as the New Mexico State Heritage Program is essential. Development of a cooperative agreement for Kuenzler hedgehog cactus and its habitat is desirable.

1222. Support State efforts to provide adequate protection for cacti.

New Mexico State laws are inadequate to provide protection against collection of E. fendleri var.

kuenzleri. The FWS should support State efforts to remedy this situation in order that the Lacey Act might also apply for protection of the species.

13. Manage existing habitat on privately owned lands, cooperatively with landowners.

To provide for the maintenance of the Kuenzler hedgehog cactus and its habitat (the majority of which exists on private land), it will be necessary to obtain the cooperation of the landowner.

131. Protect habitat on private lands.

Upon the establishment of a working relationship, agreements should be negotiated to achieve protection for the Kuenzler hedgehog cactus and its habitat. The majority of the occupied habitat is on private land with no legal protection from collection or habitat destruction; therefore, this task is essential to prevent the extinction of the species and has been given a priority 1 rating.

132. Develop and implement habitat management plans for all existing Kuenzler hedgehog cactus habitat on private land.

Habitat management plans should be prepared for all Kuenzler hedgehog cactus habitats, to coordinate recovery efforts and to establish goals and objectives for future work. Once prepared, these plans should be implemented.

1321. Regulate land use for the benefit of E. fendleri var. kuenzleri.

Any detrimental human activities and uses of land should be identified and methods formulated to alleviate the impact. The effects of such activities as grazing and mining, should be analyzed and managed to minimize the negative effects.

1322. Enhance and improve existing habitat.

Any potential for sustaining larger, healthier Kuenzler hedgehog cactus populations should be analyzed and improvement or enhancement measures should be taken.

2. Obtain data to facilitate management decisions to sustain and reestablish healthy populations in their natural habitat.

Actions below are necessary for effective management decisions to protect the Kuenzler hedgehog cactus and its habitat.

21. Inventory for E. fendleri var. kuenzleri.

The search for new populations outside the known range should continue, especially on federally administered lands but also on State and private lands. The red fruits of this taxon lend to

dispersal of seed by birds; therefore we could expect to find additional new populations outside the known range.

Within the known range, the inventory of populations should continue. Populations need to be mapped and individuals counted. Some populations should be mapped using a nearest neighbor method to allow comparative long-term studies.

22. Investigate genetic relationship between E. fendleri var. kuenzleri and other varieties of E. fendleri for use in reintroduction activities.

Echinocereus fendleri var. kuenzleri appears to be a valid taxon but genetic parameters and relationships to the typical variety are poorly understood. The following studies will aid in understanding areas appropriate for reestablishment of wild populations.

221. Compare morphological variations.

Morphological variations between the varieties are insufficiently understood and need further study.

222. Make chromosome counts.

Chromosome counts should be made on several isolated populations of each of the varieties of E. fendleri.

223. Conduct electrophoretic/chromatographic studies.

Electrophoretic and chromatographic studies need to be conducted on the entire complex. Populations from throughout the ranges of these entities should be used.

23. Study environmental parameters.

Studies of environmental parameters of the apparent preferred habitat would yield information better delineating habitat requirements. This would not only aid reintroduction and management efforts, but would enhance survival of cultivated plants.

231. Soils.

Detailed knowledge of soils of the preferred habitat of this cactus would help select areas for further search and answer questions on distribution limits.

232. Water and temperature relations.

Information on the relationship between precipitation and/or water availability and germination patterns would benefit seeding and transplant efforts, and survivability of cultivated plants. Knowledge of temperature preferences and limits are also necessary.

233. Slope and aspect preferences.

A better delineation of anticipated slope and aspect pre-

ferences would be useful in locating new populations, or in reestablishing populations.

234. Investigate biotic relationships.

Various aspects of pollination, dispersal vectors, the effects of grazing and rodents on the cactus need investigation.

2341. Construct exclosures for long-term study.

Exclosures of two types, one excluding livestock and the other excluding rodents, are necessary to determine effects of livestock grazing and seed predation on this cactus. A smaller, rodent exclosure can be placed inside the livestock exclosure. At least one exclosure for each major soil or vegetation type is preferred.

2342. Seed dispersal.

Seed dispersal studies would be useful in predicting distribution patterns or in recovery of populations.

2343. Pollinators.

An understanding of the pollinators and pollination

systems would aid in reintroduction efforts, range delineation, and reproduction experiments.

24. Study population biology.

Presently, almost nothing is known about the population biology of Kuenzler's hedgehog cactus, this information is needed to effect recovery of the species.

241. Life history characteristics.

The frequency of establishment of seedlings, survivorship, fecundity, density dependence as it relates to pollination and seed-set, and the reproductive index of the taxon are factors that need to be investigated.

242. Demographic trends.

A determination of population trends as related to human activities and natural factors is necessary to determine future allowable seed harvest and assess transplant or other population augmentation needs.

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 FWS policy on the cactus trade problem and will allow the drafting of a CTMP.

31. Develop a trade study.

Documentation of the source and identity of species in the trade is of primary concern to the development of trade 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 affected by trade. Natural changes in population as well as the success of recovery efforts would also be measured by the monitoring study. The impact of seed collection, and taking of cuttings are needed to understand harvest limits on the species. It is also necessary to understand collection impacts, time of collection, and other aspects needed to identify high priority law enforcement tasks.

33. Determine feasibility of reducing the collecting pressure on the wild populations by promoting a commercial, artificial propagation program.

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 always exist 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. Investigate propagation techniques and reintroduction methods for E. fendleri var. kuenzleri.

The pressure of collecting on natural populations may be reduced by providing adequate supplies of propagated specimens into the trade and/or by reintroducing into depleted historic habitat.

41. Develop improved propagation techniques and reintroduction methods.

Cultivation of seed stock can be hastened by using grafted propa-

gules rather than individuals raised from seed. Methods for reintroduction should be investigated to establish appropriate procedures.

42. Reintroduce cultivated plants into depleted suitable habitat within the species' historic range.

A wild population of 5,000 plants is estimated as a goal necessary for consideration of downlisting to threatened. This number will be evaluated for adequacy once attained. If studies on density dependence indicate that a specific density of the flowering plants increases seed set, depleted populations below that density can be augmented by introducing cultivated specimens. Reintroduction of cultivated plants to unoccupied suitable habitat within its historic range may also enhance recovery efforts provided adequate safeguards are established to ensure that genetic contamination does not occur. Reintroduction to locations susceptible to illegal collection should be given the lowest level of priority.

43. Consider providing propagated stock to outlets for commercial use.

For species where collection pressures are contributing to their decline, alleviation of these procedures are necessary for species' recovery. Prohibition of collecting may alleviate some pressures but may also create additional black market

demand. Providing stock to trade outlets as soon as possible may help in decreasing black market demand. An estimated goal of 10,000 propagated plants per year may be required to satisfy the commercial market.

5. Develop public awareness, appreciation, and support for recovery of E. fendleri var. kuenzleri.

Education of the public and government personnel is a vital part of the recovery process. Cooperation at all levels is essential for the ultimate success of the recovery of this species. Local public interest groups need to be involved because the visibility of their support can be instrumental in shaping public concern.

Literature Cited

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PART III

IMPLEMENTATION SCHEDULE

The Implementation Schedule that follows is a summary of scheduled actions and costs for the Kuenzler hedgehog cactus recovery program. It is a guide to meet the objectives of the Recovery Plan for the Kuenzler Hedgehog 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" denotes a task that once begun should continue on an annual basis), the agencies that are responsible to perform these tasks, and lastly, the estimated costs for FWS tasks. Implementing Part III is the action of the recovery plan, that when accomplished, should bring about the recovery of the endangered Kuenzler hedgehog 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 and 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

BIA - Bureau of Indian Affairs
BLM - Bureau of Land Management
FS - U.S. Forest Service
FWS - U.S. Fish and Wildlife Service
SE - Office of Endangered Species
LE - Law Enforcement
RE - Realty
TNC - The Nature Conservancy
NM - State of New Mexico

PART III
IMPLEMENTATION SCHEDULE

GENERAL CATEGORY (1)	PLAN TASK (2)	TASK # (3)	PRIORITY # (4)	TASK DURATION (5)	RESPONSIBLE AGENCY FWS REGION (6)	FWS PROGRAM (6a)	OTHER (7)	FISCAL YEAR COSTS (EST.)* FY1 (8)	FY2	FY3	COMMENTS (9)
02	Enforce existing regulations.	11	1	Ongoing	2	LE	FS BLM NM	existing funding			
M3	Develop FS and BLM management plans.	121	1	1 year	2	SE	FS BLM	existing funding			
M3,03	Coordinate efforts with State of New Mexico.	122	2	Ongoing	2	SE	NM	500	500	500	
A3	Protect habitat on private lands.	131	1	3 years	2	SE RE	TNC	5,000	1,000	1,000	
M3	Develop and implement habitat management plans.	132	2	Ongoing	2	SE	TNC	500	500	500	
R1	Inventory for E. fendleri var. kuenzleri.	21	2	3 years	2	SE	FS BLM BIA NM	5,000	5,000	5,000	
R5	Investigate genetic relationships.	22	3	1 year	2	SE		5,000			
R2,R3	Study environmental parameters.	23	2	3 years	2	SE	TNC	15,000	5,000	5,000	

*Costs refer to USFWS expenditures only.

PART III
IMPLEMENTATION SCHEDULE

GENERAL CATEGORY (1)	PLAN TASK (2)	TASK # (3)	PRIORITY # (4)	TASK DURATION (5)	RESPONSIBLE AGENCY FWS REGION (6)	RESPONSIBLE AGENCY FWS PROGRAM (6a)	RESPONSIBLE AGENCY OTHER (7)	FISCAL YEAR COSTS (EST.)* FY1 (8)	FY2	FY3	COMMENTS (9)
R1	Study population biology.	24	2	3 years	2	SE	TNC	20,000	5,000	5,000	
R14	Develop a trade study.	31	2	1 year	2	SE		20,000			
R1	Develop a monitoring study.	32	2	Ongoing	2	SE		20,000	10,000	10,000	
R7	Determine the feasibility of reducing collecting pressure by promoting artificial propagation programs.	33	2	1 year	2	SE		15,000			
02	Develop Law Enforcement strategy.	34	2	1 year	2	SE LE		2,000			
R7	Investigate propagation techniques and reintroduction methodologies.	4	3	3 year	2	SE		10,000	5,000	5,000	
01	Develop public awareness.	5	3	Ongoing	2	SE		5,000	1,000	1,000	

*Costs refer to USFWS expenditures only.

APPENDIX

List of Reviewers

An Agency Review Draft of the Kuenzler Hedgehog Cactus Recovery Plan was sent to the following agencies for their review on October 16, 1984.

Regional Forester U.S. Forest Service, Region 3

Superintendent, Mescalero Agency, Bureau of Indian Affairs

Secretary, New Mexico Department of Natural Resources

New Mexico State Director, Bureau of Land Management

Director (AFA), USFWS, Washington, D.C.

Law Enforcement, USFWS, Region 2

Realty, USFWS, Region 2

Ecological Services, Albuquerque Field Office, USFWS, Region 2

Comments Received

Letters of comment on this plan have been reproduced in this section, followed by an outline of the responses made to each comment.

United States Department of Agriculture
Forest Service
Region 3
517 Gold Avenue, SW
Albuquerque, NM 87102

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AA
AFF
AWR
AHR
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PAO
EEO
FILE SE
Action
CL-12-3

End. Sp. R-2	
✓	JOHNSON
	LANGOWSKI
	Bowman
	Burton
	Carley
	Halvorson
	Hoffman
✓	Olwell
	Stefferud
	Botanist
	Hopp
	Padilla
	SANCHEZ
FILE	

Reply To: 2670

Date: NOV 30 1984

Michael J. Spear, Regional Director
U.S. Fish and Wildlife Service
P.O. Box 1306
Albuquerque, NM 87103

Dear Mr. Spear:

We have reviewed the second draft Recovery Plan for Kuenzler Hedgehog Cactus, a cactus occurring on the Lincoln NF and adjacent lands in New Mexico. Since this species occurs in only one Forest Service Region, the Regional Forester, Southwestern Region (R-3), has authority to respond for the Agency. The Forest Service recommends approval of the recovery plan subject to the following revisions:

A-1 1. A goal of 5000 plants in the wild population is established for downlisting from endangered to threatened status. What is the delisting goal? What are the target dates for downlisting and delisting?

Recommendation: Establish target dates for downlisting and delisting and a delisting goal.

A-2 2. The Forest Service will have a substantial role in the recovery process yet only agency general responsibilities are identified (Stepdown items 112 and 121). What specific responsibilities are identified to agencies?

Recommendation: Identify specific recovery objectives to cooperating agencies so that these can be incorporated into internal agency planning and budgeting processes.

Thank you for the opportunity to comment.

Sincerely,

for M. J. HASSELL
Regional Forester

cc:
WO
Lincoln
Range

FWS REG 2
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SE

DEC 4 1984

FS-6200-28(7-82)

The Nature Conservancy

New Mexico Field Office
Post Office Box 1846 / Albuquerque, New Mexico 87103
610 Gold S.W., Suite 202
(505) 242-2015

January 7, 1985

End. Sp. R-2	
JOHNSON	
LANGOWSKI	
Bowman	
Burton	
Carley	
Halvorson	
Holmes	
Olwell	B
Steffeud	
Botanist	
Hope	
Padilla	
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Mr. Conrad A. Fjetland
Endangered Species Office
U. S. Fish & Wildlife Service
P. O. Box 1306
Albuquerque, New Mexico 87103

Dear Mr. Fjetland:

B-1 We apologize for our late comments on the Recovery Plan for the Kuenzler Hedgehog Cactus. I have reviewed the Recovery Plan as prepared by Reggie Fletcher and support your effort. You should know that The Nature Conservancy does lease the land that has the largest population of this cactus and we would look forward to any future agreement proposed by the Fish and Wildlife Service for management of this species.

Very truly yours,

John C. Egbert
State Director

JCE/mh

REC'D
FWS-Region 2
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JAN 10 '85
SE

National Office
1800 North Kent Street
Arlington, Virginia 22209

Western Regional Office
156 Second Street
San Francisco, California 94105

IN REPLY REFER TO:

6840 (931)

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
NEW MEXICO STATE OFFICE
Post Office and Federal Building
P.O. Box 1449
Santa Fe, New Mexico 87504-1449

NOV 9 1984

	End. Sp. R-2
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	SANCHEZ
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Memorandum

To: Assistant Regional Director, Region 2, FWS, Albuquerque, NM

From: Deputy State Director, Lands and Renewable Resources, BLM, Santa Fe, NM

Subject: Knowlton Cactus and Kuenzler Hedgehog Cactus Draft Recovery Plans

We have reviewed the subject recovery plans and have no comments.

C-1 We are aware that these plants occur on public lands administered by our agency and we will continue to cooperate with the Fish and Wildlife Service in these efforts.

Thank you for the opportunity to review the subject recovery plans.

David F. Jones

FWS RLG 2
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Responses to Comments

A-1 An interim downlisting goal has been established at a wild population level of 5000 plants for a period of 5 years. A delisting goal cannot be proposed until the status of the plant is considered sufficiently stable and protected. A review will take place at that time and delisting goals will be formulated.

A-2 Specific financial responsibilities are not cited because this is a FWS document only and the recovery plan does not give the opportunity to responsible agencies to approve the document. Clarification that the Implementation Schedule does not include the monetary needs for full recovery of the species is included on page 35.

B-1 Comment noted and information incorporated into recovery plan.

C-1 Comment noted and your continued cooperation is appreciated.