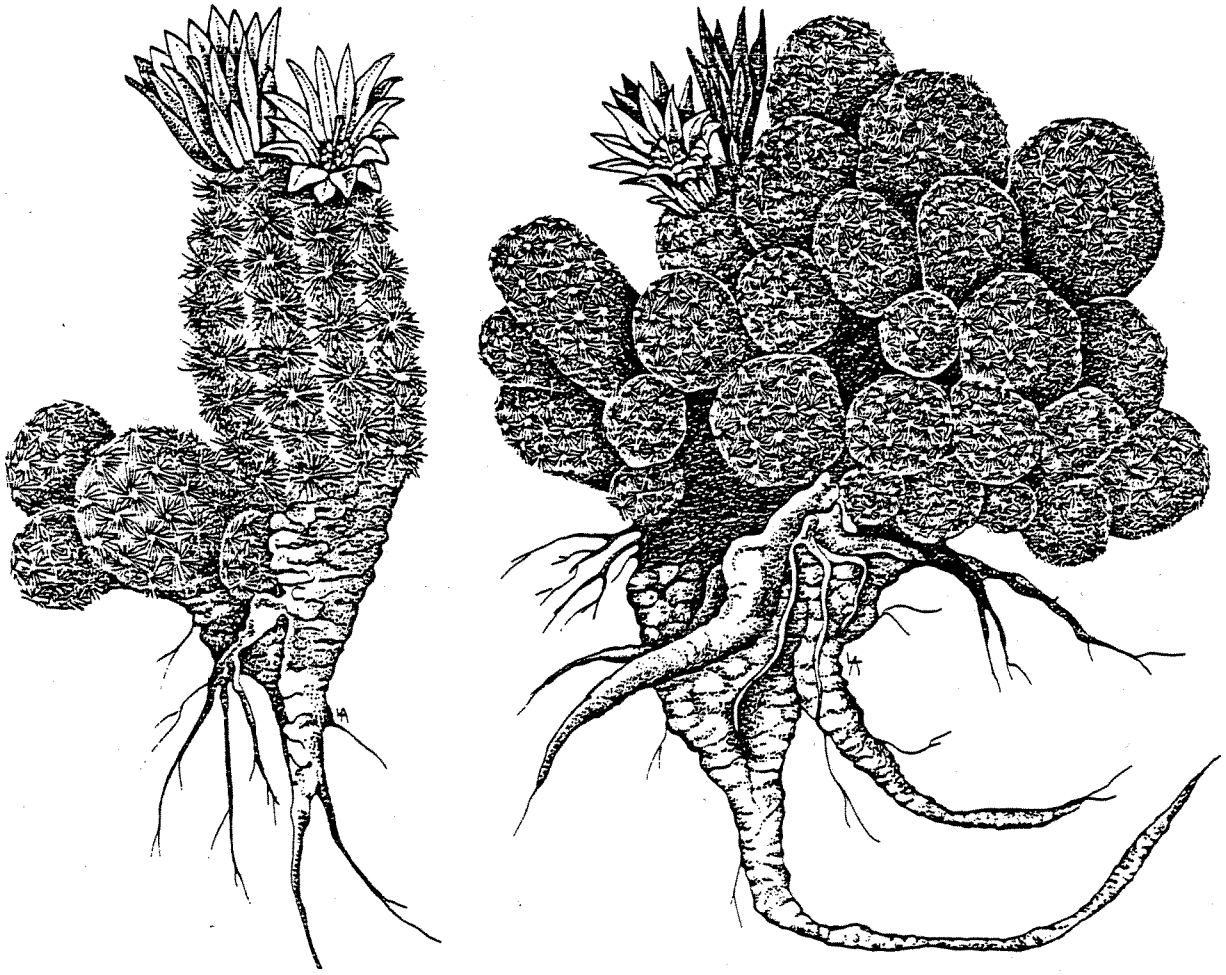
SNEED AND LEE PINCUSHION CACTI

(Coryphantha sneedii var. sneedii

Coryphantha sneedii var. leei)

RECOVERY PLAN



U.S. Fish and Wildlife Service

Albuquerque, New Mexico

1986

SNEED AND LEE PINCUSHION CACTI

Coryphantha sneedii var. *sneedii*

Coryphantha sneedii var. *leei*

RECOVERY PLAN

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DISCLAIMER

This is the completed Sneed and Lee Pincushion Cacti 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:

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SUMMARY

Goal:	To remove the endangered Sneed pincushion cactus and the threatened Lee pincushion cactus from the Federal list of threatened and endangered species by managing their essential habitat to sustain natural populations in the wild.
Recovery Criteria:	The criteria for downlisting the Sneed pincushion cactus to threatened will be to establish at least six secure populations with a total of at least 20,000 plants. At least three populations should be in the Franklin Mountains or southern Organ Mountains of New Mexico and Texas, and at least three should be in the Guadalupe Mountains of New Mexico and Texas. Criteria for delisting the Sneed and Lee pincushion cacti have not yet been determined. The implementation of studies in this recovery plan will provide the necessary data from which quantified delisting criteria can be established.
Actions Needed:	Major steps to meet the recovery criteria include: The development and implementation of habitat management plans that alleviate the threats of collecting and habitat modification; the enforcement of existing regulations on collecting and trade; the study of population biology to develop the understanding needed to sustain healthy populations in their natural habitat; and, the development of public awareness, appreciation and support for preservation of the Sneed and Lee pincushion cacti.

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PART I

INTRODUCTION

Brief Overview

The Sneed pincushion cactus, Coryphantha sneedii (Britton & Rose) Berger var. sneedii, was listed as endangered on November 7, 1979 (44 FR 64743) and the Lee pincushion cactus, C. sneedii var. leei (Rose ex Bodeker) L. Benson was listed as threatened on October 25, 1979 (44 FR 61558). Neither species was listed with critical habitat. One other member of this genus, the Nellie cory cactus (C. minima), is listed as endangered and two others, the bunched cory cactus (C. ramillosa and the Cochise pincushion cactus (C. robbinsorum), are listed as threatened. The 1985 notice of review (50 FR 39526) includes seven candidates from this genus for possible future listing under the Endangered Species Act.

The Sneed pincushion cactus occurs in west Texas and southern New Mexico and the Lee pincushion cactus grows only in southeastern New Mexico. These cacti are threatened by collection and destruction of habitat.

The objective of this plan is the recovery of the Sneed and Lee pincushion cacti by increasing their numbers in the wild and by removing threats to these cacti and their habitats. Attainment of these goals may lead to the ultimate objective of removal of the Sneed and Lee pincushion cacti from the Federal list of endangered and threatened species.

Taxonomy

Coryphantha sneedii var. sneedii was first collected by J.R. Sneed in 1921 from the Franklin Mountains, El Paso County, Texas, and was described by Britton and Rose as Escobaria sneedii (Britton & Rose, 1923). The name Coryphantha pygmaea Fric, published in 1924, is a synonym (Benson, 1982). In 1929, Berger placed the cactus in the genus Coryphantha. In Cacti of the Southwest, Del Weniger (1970) follows the treatment of Cory (1936), calling the cactus Mammillaria sneedii.

Coryphantha sneedii var. leei was first collected in 1924 by W.T. Lee. In 1925, it was named Neomammillaria leei by J.N. Rose, but the name is not valid under the code of botanical nomenclature because a description was not written for the plant (Weniger, 1970; Benson, 1982). Frederick Bodeker made an incomplete description (but sufficient for the code) calling the plant Escobaria leei (Bodeker, 1933).

In 1967, E.F. Castetter and Prince Pierce published the first complete description of the Lee pincushion cactus (Castetter and Pierce, 1967). In 1969, Lyman Benson named the cactus Coryphantha sneedii var. leei (Benson, 1969). In Cacti of the Southest, Del Weniger (1970) uses the name Mammillaria leei, a combination that was not published correctly in accordance with the code of botanical nomenclature.

Some taxonomists place the Sneed and Lee pincushion cacti in the genus Escobaria citing a combination of characters that make these and several other species distinct from other members of the genus Coryphantha (Castetter, et al., 1975). Benson (1982) retains all species of Escobaria within Coryphantha. Both treatments are frequently used but Benson's is followed in this plan.

Morphology

Both the Sneed and Lee pincushion cacti are many branched, forming tight clumps of up to 100 or more stems. Individual stems are cylindroid or spherical to club-shaped, 2.5-7.5 cm long (1.0-2.9 inches) and 1-3 cm in diameter (0.4-1.2 inches) with tubercles up to 3mm long (0.12 inches). The tubercles are persistent and hard after fall of the spines. The spines hide the stem. The central spines are acicular, white, tipped with pink and brown, 3-14 cm long (1.2-5.5

inches) and about 6-17 per areole. The radial spines are white, 3-12 mm long (0.2-0.47 inches) and 35-90 per areole. The flowers are about 1.2 cm tall (0.5 inches) and of equal diameter, not opening widely; they are brownish-pink to pale rose with pink filaments and bright orange anthers. The fruits are greyish-green, or greenish tinged with brown, or rarely pinkish when ripe. They are clavate up to 1.5 cm long (0.6 inches) and 6 mm in diameter (0.24 inches). The seeds are reddish-brown, 0.7-1 mm long (.027-.039 inches), and 1.25-1.5 mm broad (.049-.059 inches) (Benson, 1982).

Varietal Characteristics

Sneed pincushion cactus--The stems have spines that are not deflexed but spread parallel to the stem surface; the flowers are pale, or medium to rose, magenta; the seeds are 0.75 mm long (.03 inches), and 1.25 mm broad (.049 inches) (Benson, 1982).

Lee pincushion cactus--The spines are deflexed on medium and small stems, slanting from the top of the tubercle toward the main portion of the stem; the flowers are dull medium brownish-pink; the seeds are 1 mm long (.039 inches) and 1.5 mm broad (.059 inches) (Benson, 1982).

Distribution and Land Ownership

The Sneed pincushion cactus was historically known only from the Anthony Gap area of the Franklin Mountains in Dona Ana County, New Mexico. It is presently known from most of the Franklin Mountains of El Paso County, Texas and Dona Ana County, New Mexico. It also occurs at the southern end of the Organ Mountains of New Mexico and in the Guadalupe Mountains of Texas and New Mexico. In all, there are 20 documented localities for this taxon; nine in the Franklin Mountains, two in the Organ Mountains, and nine in the Guadalupe Mountains (NMNHP, 1985) (Figure 1). Of the 20 localities for Sneed pincushion cactus, seven occur on private lands in the Franklin Mountains, El Paso County, Texas; two occur on Bureau of Land Management (BLM) administered land in Dona Ana County, New Mexico; two occur on Fort Bliss Military Reservation; three occur on Lincoln National Forest, Eddy County, New Mexico; two occur on Guadalupe Mountains National Park, and four occur on Carlsbad Caverns National Park (NMNHP, 1985).

The historic and present distribution of the Lee pincushion cactus are the same. It occurs in only one known location: Carlsbad Caverns National Park, Eddy County, New Mexico (Benson, 1982; Castetter and Pierce, 1966; Sabo and Wagner, 1977; Weniger, 1970) (Figure 2).

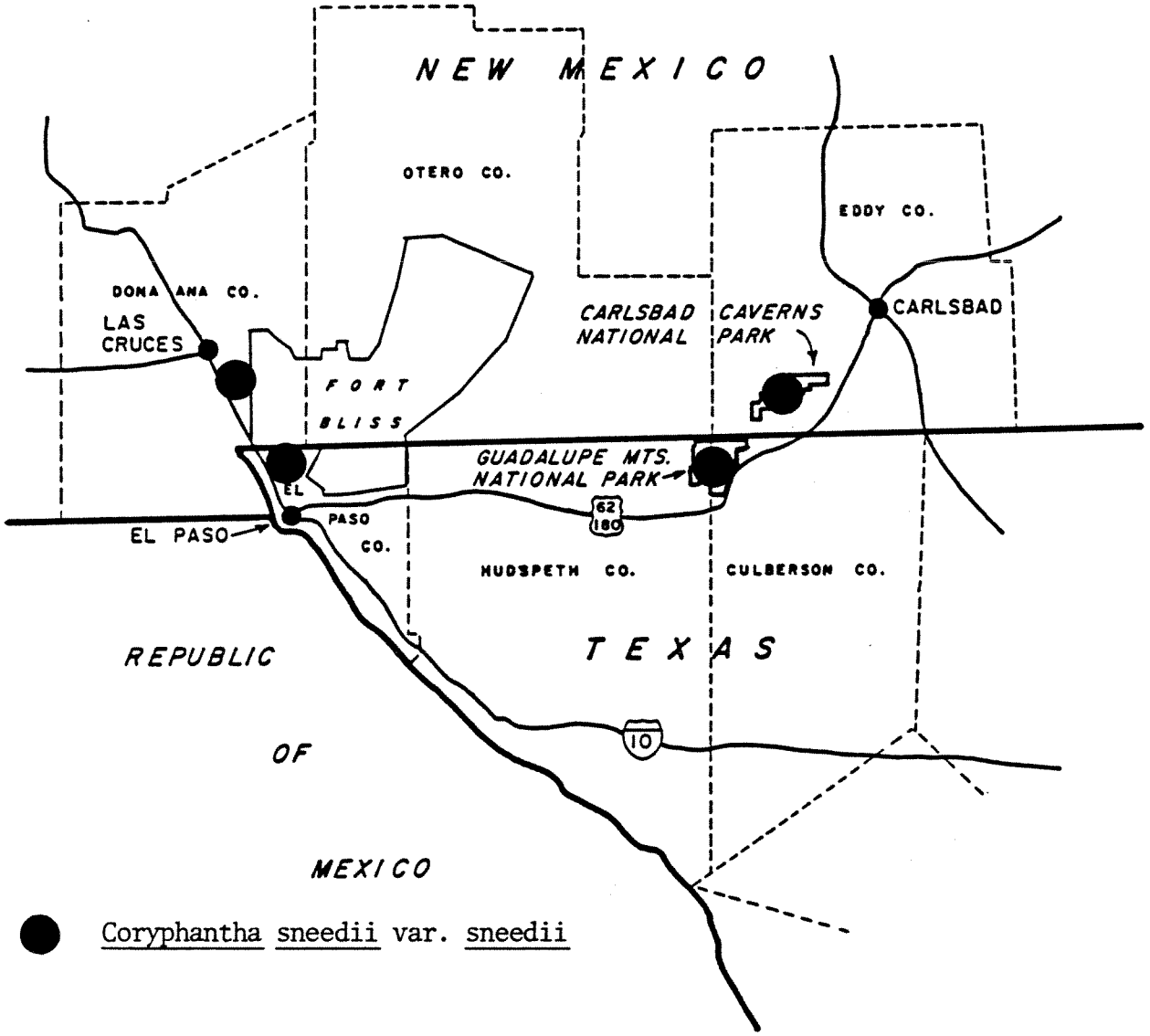

Figure 1. General location of Coryphantha sneedii var. sneedii.

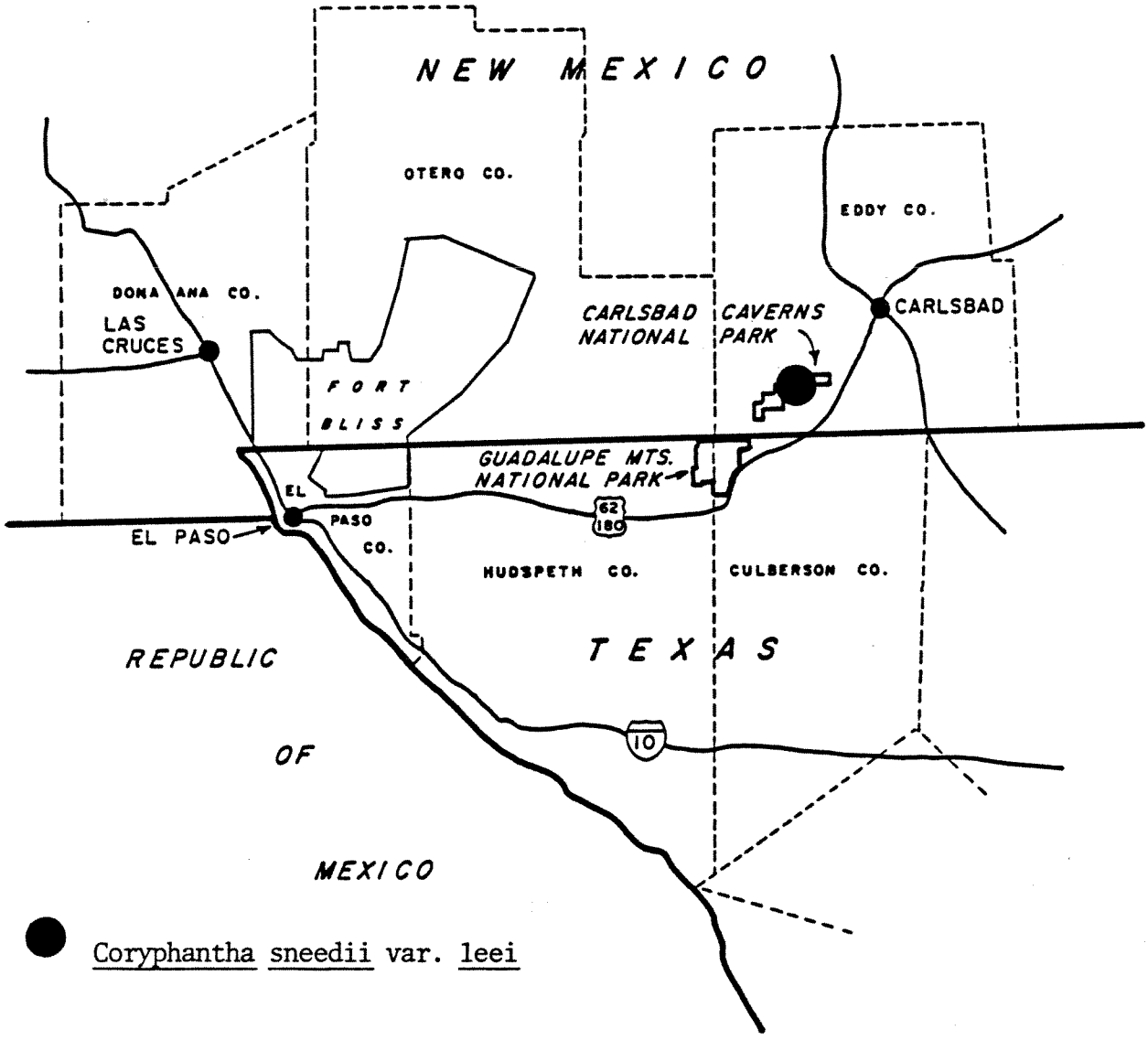

Figure 2. General location of Coryphantha sneedii var. leei.

Habitat

The Sneed and Lee pincushion cacti grow in semi-desert grassland (Brown, 1982). The Sneed pincushion cactus is restricted to limestone and grows in cracks on vertical cliffs or ledges. The Lee pincushion cactus is restricted to the Tansil Limestone Formation and grows on north-facing ledges. The limestones are generally hard, resistant to erosion, and support a sparse vegetation of low shrubs, some rosette-forming perennials, many cacti, and both annual and perennial herbs. Characteristic species include:

Agave leuchuquilla

Ancistrocactus uncinatus var. *wrightii*

Andropogon spp.

Bouteloua curtipendula

Coryphantha strobiliformis

C. vivipara var. *neomexicana*

Dasylirion wheeleri

Echinocactus horizonthalonius

Echinocereus triglochidiatus var. *gurneyi*

E. pectinatus var. *neomexicanus*

E. stramineus

Ephedra trifurca

Epithelantha micromeris

Fallugia paradoxa

Juniperus pinchotii

Krameria grayi

Munroa squarrosa

Nolina texana

Notholaena sp.

Opuntia phaeacantha

O. engelmannii

O. imbricata

O. microrhiza

Quercus spp.

The edaphic requirements of the Sneed and Lee pincushion cacti are poorly known and need to be determined to provide clues to factors restricting their distribution.

The Sneed pincushion cactus grows at an elevation of 1,200-2,350 m (3,900-7,700 feet) in areas where the average precipitation varies from 19.7-40.0 cm/year (7.8-15.7 inches/year). The Lee pincushion cactus grows at an elevation of 1,200-1,500 m (3,900-4,900 feet) in an area where the precipitation averages 30 cm/year (11.8 inches/year).

Population Biology

Sneed Pincushion Cactus

Many of the current localities for the Sneed pincushion cactus are only documented by herbarium records with little known about the size or status of the populations from which the specimens came. There are no estimates for the total number of plants at all localities, but Heil and Brack (1985a) have estimated the total number of Sneed pincushion cacti in Carlsbad Caverns National Park to exceed 100,000. This figure, however, needs verification through quantitative sampling. Within populations at Carlsbad Caverns National

Park, plant density varies widely. One $10m^2$ area may contain 20 individuals while a similar area nearby will not support a single plant (Heil and Brack, 1985b).

Plants of Sneed pincushion cactus are multistemmed with stems of two types. One type of stem remains small and probably serves to start new plants when they break off. The other type of stem is larger, more rigidly attached and produces flowers, fruits, and seeds. The average number of stems per plant at Carlsbad Caverns National Park is about 27 with about 11 flowering stems per plant.

Most Sneed pincushion cacti bloom after 3-4 years. Plants bud from March to April with the principal blooming period in April. It is the first pincushion cactus species to flower, well before Coryphantha strobiliformis with which it is suspected of hybridizing. Flowers open in midday, usually between 10:00 am and 4:00 pm and last 2-4 days. Rarely, a very late flowering Sneed pincushion cactus and an early C. strobiliformis might flower on the same day, but flowers of C. strobiliformis open from approximately 4:00 pm until sundown. Some plants of Sneed pincushion cactus have been observed blooming in July and August. This uncharacteristic second blooming season is believed to occur after summer rains.

Fruit formation for the Sneed pincushion cactus is from August to November. The percentage of fruit set under natural conditions is about 90 percent. In cultivation, virtually 100 percent of the flowers produce fruits. No sterile plants have been observed. Fruits do not dehisce and when ripe, project barely, if at all, over the tips of the spines. The fruits have a prune-like odor when ripe and attract rodents which are likely dispersal agents. Birds have been noted to feed on the fruits and should, at least occasionally, serve as dispersal agents. Some fruits crumble with age, and water disperses the seeds.

Fruits from Slaughter Canyon, Carlsbad Caverns National Park averaged about 18 seeds per fruit. With about 11 flowering stems per plant, about 140 seeds per plant are produced each year. Seeds remain viable for at least 10 years. The best seedling survival is under rocks or deep in the cracks of rocks where seedlings are protected. Seedlings were present in all observed populations.

Lee Pincusion Cactus

The Lee pincushion cactus is known only from populations within Carlsbad Caverns National Park with an estimated 1,000-2,000 plants (Heil and Brack, 1985a). Plant density in

populations varies widely. One $10m^2$ area may contain 5-10 individuals while a similar area nearby will not support a single plant.

As with the Sneed pincushion cactus, this taxon has two types of stems. Only about 10 percent of all stems are of the non-flowering type, and these are often broken off by animals or shifting rocks and may root, establishing new plants.

Most Lee pincushion cacti bloom after 3-4 years. Plants bud in late March or early April. Winter and spring moisture is important for bud set. Plants favor north-facing slopes where the soil is cooler and more moist. Buds mature quickly and in favorable weather flowers are produced in 2-4 weeks. Flowers generally last 3-4 days, less if fertilized earlier. No evidence of sterile plants, or flowers without pollen has been seen, nor is there any evidence of hybridization.

Fruit formation is from August to November. Plants are clustered in populations so a very high percentage of flowers are pollinated. In cultivation, virtually 100 percent of all flowers develop fruits with viable seeds. Ripened fruits do not dehisce and barely project above the bundle of spines covering the apex of the stem. Most fruits are eaten by insects or by rodents who probably scatter a few seeds in the

process. Birds have also been observed to feed on the fruits and should at least occasionally serve as dispersal agents. If a fruit is not eaten, which happens to a sizeable portion of them, weathering breaks down the fruit wall causing the seeds to be dispersed by wind and rain.

Each fruit produces about 26 seeds and a flowering stem produces about 6 fruits. A typical plant may produce over 1,000 seeds per year. In cultivation, germination and survival of seedlings is usually over 80 percent. Since seeds can remain viable for up to 10 years, the soil probably contains a sizeable seed bank. Seeds need a proper combination of moisture and temperature to germinate. The best germination and survival occurs when seeds fall onto a layer of fine limestone pebbles over a large flat stone slab which traps soil moisture above the impermeable rock. The soil must be very stable because any disturbance is likely to kill the tiny seedlings. Seeds probably germinate during the summer rainy season. For successful seedling establishment, rains need to come within a certain number of days of each other and not fall hard enough to wash out or dislodge the tiny seedlings. Only after several months to a year will the seedlings emerge above the pebbly surface and become visible. Even with these special conditions, seedlings were observed throughout the populations.

Impacts and Threats

Threats to the Sneed and Lee pincushion cacti are principally of three types: direct collection by commercial or private collectors, destruction or modification of habitat, and natural threats.

Sneed Pincushion Cactus

1. Commercial and private collectors.

It is difficult to determine the impact collecting has had on the Sneed pincushion cactus and how much collecting is still continuing. Many collectors know of the privately owned O'Hara Canyon site in the Franklin Mountains, Texas. This site was heavily collected by cactus fanciers about twenty years ago (Clark Champie, pers. comm., 1984). In May, 1984, the Sneed pincushion cactus was still quite common at O'Hara Canyon with many large plants at this location. Some hiking must be done to reach the cacti at this site. Many other sites in the Franklin Mountains are, however, more easily accessible and if better known would be more likely to suffer from collecting. The Guadalupe Mountains and Carlsbad Caverns National Parks contain large numbers of the Sneed pincushion cactus. Within these parks, collecting is illegal and most sites where the cactus grows are difficult to reach.

Though not showy, some collectors prize the Sneed pincushion cactus for its unusual appearance and rarity. Private and/or commercial collectors could have a strong impact on some populations. However, this cactus is not presently popular with general collectors, but rather only with those who specialize in rare species.

2. Destruction or modification of habitat.

There has been some destruction of habitat on private land within the Franklin Mountains, Texas. As the city of El Paso grows, more room will be needed for roads, housing, and commercial development. Private land within the Franklin Mountains is already being used for housing development. Another potential threat is trail and other development within Guadalupe Mountains and Carlsbad Caverns National Parks. There are presently no plans to modify habitat where the Sneed pincushion cactus grows on BLM or military lands. However, some unoccupied but possibly suitable habitat on military land is presently used as an artillery impact area.

3. Natural limiting factors and threats.

Much unoccupied but apparently suitable habitat occurs within the range of the Sneed pincushion cactus. Such factors as seed predation, damage by grazing animals, competition for space, or special edaphic requirements could be

restricting the plant's distribution. Presently, however, the biology and ecology of Sneed pincushion cactus are too poorly understood to identify specific natural threats.

Lee Pincushion Cactus

1. Commercial and private collectors.

At present, collecting is not a major threat to the Lee pincushion cactus. This cactus is not popular among most collectors, but rather only among those who specialize in the rare species. Plant collecting on the National Park is subject to strict control by the Park Service. However, the Lee pincushion cactus grows near a road where there is easy access. Only if this cactus becomes popular among cactus fanciers would collecting become a major threat.

2. Destruction or modification of habitat.

The National Park Service needs to protect the Lee pincushion cactus against any further development within the essential habitat of this plant. At present, there are no campgrounds at Carlsbad Caverns National Park; however, if the Park Service decides to create a campground within the Park, and if it chooses the area where the Lee pincushion

cactus occurs, it would be a major threat. Other potential threats include new trail development or development of picnic sites within the area of the Lee pincushion cactus.

3. Natural limiting factors and threats.

Many species of plants grow on the Tansil Limestone Formation and competition for space may restrict the Lee pincushion cactus. The Lee pincushion cactus grows only on the Tansil Limestone Formation and only on north-facing exposures. These special requirements restrict the plant's distribution. A natural fire or intentional burn could have a devastating impact on the Lee pincushion cactus. Conversely, although fires may destroy some plants, the overall effect could be beneficial if competing species are eliminated. The effect of fire needs to be studied before fire is used as a management practice in areas occupied by the plants.

Animal trampling has a negative effect on seedling establishment and survival. If populations of grazing animals (principally deer) are not controlled, there is the possibility that plants will be destroyed. The deer population should be studied to see that the density does not reach levels which would be detrimental to the plants.

PART II

RECOVERY

Objectives

The overall objectives of this recovery plan are to restore the endangered Sneed pincushion cactus to a level where it can be downlisted to threatened and eventually delisted, and to restore the threatened Lee pincushion cactus to a level where it can be delisted. These overall objectives can be accomplished by protecting the cacti from present and future human threats of collecting and/or habitat destruction and ensuring that the cacti are maintained as vigorous self-sustaining populations throughout their natural habitat.

It is believed that downlisting of the Sneed pincushion cactus to threatened can be initiated when: 1) Six or more secure populations are established with at least three each near the eastern (Guadalupe Mountains) and western (Franklin Mountains and southern Organ Mountains) limits of the plant's known range; and 2) when the known number of plants in these six secure populations totals 20,000.

Populations will be considered secure when land managing agencies, organizations or individuals have developed and implemented habitat management plans for the Sneed pincushion cactus. At a minimum, the plans should contain methods for securing populations against present and future potential threats, methods for accurately quantifying population sizes, and methods for monitoring populations to determine their stability, growth, or decline.

Criteria for delisting the Sneed and Lee pincushion cacti cannot be established until more is known about their habitat and abundance. Accomplishment of the tasks in this plan should provide the data needed to establish full delisting criteria. The following step-down outline and narrative contains the tasks necessary to accomplish the recovery objectives for the Sneed and Lee pincushion cacti.

Step-Down Outline

1. Remove threats of collecting by enforcement of existing regulations.
    11. Determine the extent and impacts of collecting.
        111. Implement a monitoring program for the Sneed pincushion cactus.

112. Continue monitoring the Lee pincushion cactus at Carlsbad Caverns National Park.

12. Develop and implement a law enforcement strategy.

121. Provide protection to impacted populations.

122. Monitor cactus and succulent trade shows.

123. Monitor commercial nurseries.

124. Monitor interstate and international trade.

13. Publicize successful law enforcement actions.

2. Manage existing habitat for protection of the cacti.

21. Agencies should remain informed of the location and status of Sneed and Lee pincushion cacti populations.

22. Develop and implement habitat management plans for all populations on public lands.

23. Seek cooperation of landowners to protect and maintain populations on private lands.

3. Gather information for use in management.

31. Study population biology and ecology.

311. Determine all mechanisms involved in seed dispersal.

312. Determine what microhabitat factors are involved in seedling establishment.

313. Determine pollination mechanisms and pollen vectors.

314. Study fire ecology.

315. Use information to establish delisting criteria.

32. Develop techniques to artificially propagate and transplant the Lee pincushion cactus.

33. Inventory known populations and search for new populations in the Franklin and Guadalupe Mountains.

4. Develop a comprehensive trade management plan for all cacti.

5. Develop public awareness, appreciation and support for preservation of the Sneed and Lee pincushion cacti.

51. Use pamphlets, talks, and slide shows to increase the public's knowledge of the Sneed and Lee pincushion cacti.

52. Enlist the support of public interest groups for the protection and preservation of the Sneed and Lee pincushion cacti.

Narrative

1. Remove threats of collecting by enforcement of existing regulations.

   Because of the rarity of the Sneed and Lee pincushion cacti, the populations must be protected by enforcement of existing international, Federal, and State regulations.

   11. Determine the extent and impacts of collecting.

   The amount of collecting needs to be determined to see if this is a major threat to the populations. Although present collecting may be small, any collecting could quickly reduce some populations.

   111. Implement a monitoring program for the Sneed pincushion cactus.

   Monitoring stations should be established to determine the number of Sneed pincushion cacti at selected sites and to quantify the loss of individuals as a direct result of collecting. Stations should be established at easily accessible sites in the Franklin Mountains, and Guadalupe and Carlsbad Caverns National Parks, with control stations at less accessible sites.

112. Continue monitoring the Lee pincushion cactus at Carlsbad Caverns National park.

Carlsbad Caverns National Park should continue monitoring the Lee pincushion cactus population for any signs of collecting or for any other impacts. A commercial collector could collect a large number of Lee pincushion cacti in a very short time and this collecting would strongly affect the reproductive success of this cactus.

12. Develop and implement a law enforcement strategy.

U.S. Fish and Wildlife Service Law Enforcement should plan measures to protect these and other cacti species.

121. Provide protection to impacted populations.

Populations that are found to be losing plants to collecting should receive surveillance during the flowering season, which is usually the period of greatest collector impact.

122. Monitor cactus and succulent trade shows.

Agents should attend trade shows undercover to check for the illegal sale of field collected

Sneed and Lee pincushion cacti and other threatened or endangered species. Any successful prosecutions through this activity would serve as a deterrent to others.

123. Monitor commercial nurseries.
Commercial nurseries should be periodically visited to check for the illegal sale of Sneed and Lee pincushion cacti and other threatened or endangered species. Nursery catalogs and sales bulletins should also be periodically checked.

124. Monitor interstate and international trade.
Instances when illegal interstate or international transport and sale of endangered species seems likely should be investigated.

13. Publicize successful law enforcement actions.
Any individuals breaking rules established under ESA, CITES, the Lacey Act, or State native plant laws regarding the Sneed and Lee pincushion cacti should be charged and convicted as a deterrent to others and the action should be published in the Cactus and Succulent Journal.

2. Manage existing habitat for protection of the cacti.

Habitat management for the Sneed and Lee pincushion cacti should be done through existing agency management procedures and through cooperation with private landowners. The following should be accomplished.

21. Agencies should remain informed of the location and status of Sneed and Lee pincushion cacti populations.

To effectively manage the habitats of these cacti, it will be necessary to be aware when any proposed projects might affect the species or their habitats. Therefore, all agencies should be informed and should maintain awareness of populations on public lands they administer.

22. Develop and implement habitat management plans for all populations on public lands.

Habitat management plans should be prepared in cooperation with Bureau of Land Management (BLM), National Park Service (NPS), Department of the Army Fort Bliss (DOA), and U.S. Forest Service (FS) to coordinate the various agency efforts and to establish goals and objectives for future work. The plans should elaborate methods by which agencies

will alleviate present and potential future threats to populations, methods for accurately determining population sizes, and methods for monitoring populations to determine their stability, growth, or decline. Plans will be subject to FWS review through Section 7 of the ESA. The development and implementation of habitat management plans is one criterion for the downlisting of the Sneed pincushion cactus. These plans and their implementation are considered crucial to protecting both cacti from declining irreversibly or becoming extinct in the foreseeable future. The success of measures elaborated in the plans should be a major factor contributing to complete recovery and ultimate delisting of these cacti.

23. Seek cooperation of landowners to protect and maintain populations on private lands.

Although populations on private land lack the protection against collecting given to those on public land, it is important that attempts be made to secure these populations. To avoid damaging plants, landowners should be made aware of their location and landowner cooperation should be sought to ensure future protection.

3. Gather information for use in management.

In-depth knowledge of the plant's growth, distribution, population biology and ecology is needed to understand habitat requirements. The knowledge gained can be used to help sustain and manage healthy natural populations.

31. Study population biology and ecology.

Generalized studies will provide information about the essential habitat of the Sneed and Lee pincushion cacti. Growth requirements and limiting factors need to be studied in detail.

311. Determine all mechanisms involved in seed dispersal.

A study is needed to determine the role of insects, rodents, and/or birds in seed dispersal of the Sneed and Lee pincushion cacti.

312. Determine what microhabitat factors are involved in seedling establishment.

Most Sneed and Lee pincushion cacti seeds germinate in the cracks of limestone or under rocks where they are well protected. A thorough study of the edaphic factors in seedling ecology is needed.

313. Determine pollination mechanisms and pollen vectors.

Study is needed to determine if plants can be self pollinated or whether outcrossing is mandatory. The only observed pollinators have been members of the halicitid bee family. Investigations should be conducted to determine the pollinators and pollination mechanisms for these cacti.

314. Study fire ecology.

It is the goal of the NPS to reintroduce fire into its natural ecological role in all backcountry areas of Carlsbad Caverns National Park. Controlled experiments are needed to determine the effect of fire on populations of the Sneed and Lee pincushion cacti. Until this is done, park personnel should continue to manage their prescribed (management) fires so that individual cacti will not be destroyed. Avoidance of prescribed fires in areas with cacti populations would be a more prudent alternative.

315. Use information to establish delisting criteria.

Information from population studies and from an evaluation of management practices will make it possible to establish quantified delisting criteria for the Sneed and Lee pincushion cacti.

32. Develop techniques to artificially propagate and transplant the Lee pincushion cactus.

Search the published literature and contact commercial cactus nurserymen to learn techniques for propagating and transplanting the Lee pincushion cactus. Projects to establish new populations through artificial propagation will only be initiated if conditions indicate that this measure will be necessary for survival of the cactus. Because of the number of existing populations of the Sneed pincushion cactus, it does not appear that transplant projects will be necessary for this variety.

33. Inventory known populations and search for new populations in the Franklin and Guadalupe Mountains.

All known populations of the Sneed and Lee pincushion cacti should be inventoried and mapped. Suitable habitat in the Franklin and Guadalupe Mountains

should be searched for additional populations of the cacti. Location, population numbers, and possible threats to all presently known and newly discovered populations needs to be thoroughly documented.

4. Develop a comprehensive trade management plan for all cacti.

Studies are needed to determine what species are in trade, the overall trend of trade in listed cacti, and the feasibility of reducing collecting pressure on wild populations by promoting a commercial, artificial propagation program. Strategies for effective implementation of law enforcement responsibilities under ESA, CITES, Lacey Act, and State laws need to be developed. These studies should be national in scope and address all cacti. The results will be used to develop policy and a comprehensive trade management plan for all cacti.

5. Develop public awareness, appreciation and support for preservation of the Sneed and Lee pincushion cacti.

Education of the public is a vital part of the recovery process. The cooperation of the public is essential to the ultimate success of the foregoing recovery measures.

51. Use pamphlets, talks, and slide shows to increase the public's knowledge of the Sneed and Lee pincushion cacti.

An appreciation of the Sneed and Lee pincushion cacti and their role in the environment needs to be developed. This can be started with educational programs such as pamphlets, talks, and slide shows.

52. Enlist the support of public interest groups for the protection and preservation of the Sneed and Lee pincushion cacti.

Public interest groups, especially local ones such as native plant societies, Lions Club, Rotary, etc., need to be involved.

Literature Cited

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PART III

IMPLEMENTATION SCHEDULE

The Implementation Schedule that follows outlines actions and costs for the Sneed and Lee pincushion cacti recovery program. It is a guide to meeting the objectives elaborated in Part II of this plan. This schedule indicates the general category for implementation, recovery plan tasks, corresponding outline numbers, task priorities, duration of tasks ("ongoing" denotes a task that once begun should continue on an annual basis), which agencies are responsible to perform these tasks, and lastly, estimated costs for FWS tasks. These actions, when accomplished, should bring about the recovery of the Sneed and Lee pincushion cacti and protect their 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 these cacti.

General Categories for Implementation Schedule

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
13. Reintroduction
14. Other information

Acquisition - A

1. Lease
2. Easement
3. Mgmt. Agrt.
4. Exchange
5. Withdrawal
6. Fee title
7. Other

Other - O

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

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

Recovery Action Priorities

1 = an action that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future.
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

FWS - USDI Fish and Wildlife Service
SE - Office of Endangered Species
LE - Law Enforcement
BLM - USDI Bureau of Land Management
NPS - USDI National Park Service
FS - USDA Forest Service
DOA - U.S. Department of the Army (Fort Bliss)

IMPLEMENTATION SCHEDULE

GENERAL CATEGORY	PLAN TASK	TASK #	PRIORITY #	TASK DURATION	RESPONSIBLE AGENCY			FISCAL YEAR COSTS (EST.)*			COMMENTS
					FWS		OTHER				
					REGION	PROGRAM		FY86	FY87	FY88	
I1	Monitor Sneed cactus populations for collecting.	111	2	3 years	2	SE	NPS DOA FS BLM	1,500	1,500	1,500	
I1	Continue monitoring Lee cactus populations.	112	2	3 years	2	SE	NPS	1,500	1,500	1,500	
02	Provide law enforcement protection to populations.	121	2	ongoing	2	SE LE	NPS DOA FS BLM	1,000	1,000	1,000	
02	Monitor trade shows.	122	2	ongoing	2	SE LE		1,000	1,000	1,000	
02	Monitor nurseries.	123	2	ongoing	2	SE LE		1,500	1,500	1,500	
02	Monitor interstate and international trade.	124	2	ongoing	2	SE LE		500	500	500	
02	Publicize law enforcement actions.	13	2	ongoing	2	SE LE		200	200	200	

*Costs refer to USFWS expenditures only.

IMPLEMENTATION SCHEDULE (continued)

GENERAL CATEGORY	PLAN TASK	TASK #	PRIORITY #	TASK DURATION	RESPONSIBLE AGENCY			FISCAL YEAR COSTS (EST.)*			COMMENTS
					FWS		OTHER				
					REGION	PROGRAM		FY86	FY87	FY88	
M3	Provide information to managing agencies.	21	2	ongoing	2	SE	NPS DOA FS BLM	100	100	100	
M3	Develop and implement habitat management plans.	22	2	ongoing	2	SE	NPS	5,000			
M3	Seek cooperation of private landowners.	23	2	ongoing	2	SE		500	500	500	
R6	Determine seed dispersal mechanisms.	311	2	5 years	2	SE	NPS DOA FS BLM	2,000	1,000	1,000	
R3	Determine seedling requirements.	312	2	5 years	2	SE	NPS DOA FS BLM	3,000	1,000	1,000	
R3	Determine pollination mechanisms.	313	2	5 years	2	SE	NPS DOA FS BLM	2,000	1,000	1,000	

*Costs refer to USFWS expenditures only.

IMPLEMENTATION SCHEDULE (continued)

GENERAL CATEGORY	PLAN TASK	TASK #	PRIORITY #	TASK DURATION	RESPONSIBLE AGENCY			FISCAL YEAR COSTS (EST.)*			COMMENTS
					FWS		OTHER				
					REGION	PROGRAM		FY86	FY87	FY88	
R14	Study fire ecology.	314	2	5 years	2	SE	NPS	4,000	2,000	2,000	
03	Establish delisting criteria.	315	3	1 year	2	SE				500	
R7	Develop artificial propagation techniques.	32	3	3 years	2	SE		2,000	2,000	2,000	
I1	Locate and inventory populations.	33	2	3 years	2	SE	NPS DOA FS BLM	5,000	5,000	5,000	
R14	Develop a trade management plan.	4	2	1 year	2	SE		20,000			
01	Develop public information materials.	51	3	1 year	2	SE		4,000			
01	Enlist support of public interest groups	52	3	ongoing	2	SE		1,000	1,000	1,000	

*Costs refer to USFWS expenditures only.

APPENDIX

List of Reviewers

An agency draft of the Sneed and Lee Pincushion Cacti Recovery Plan was sent to the following agencies for their review on August 23, 1985.

Regional Forester, Region 3, U.S. Forest Service, Albuquerque, NM

Secretary, New Mexico Department of Natural Resources, Santa Fe, NM

Executive Director, Texas Parks and Wildlife Department, Austin, TX

Commander, USAADACEN and Fort Bliss, Fort Bliss, TX

Director, Texas Natural Heritage Program, Austin, TX

Regional Director, Southwest Region, National Park Service, Santa Fe, NM

State Director, Bureau of Land Management, Santa Fe, NM

Field Supervisor, Ecological Services, Fort Worth Field Office, USFWS, Region 2

Field Supervisor, Ecological Services, Albuquerque Field Office, USFWS, Region 2

Special Agent, Law Enforcement, USFWS, Region 2

Director (AFA), Office of Endangered Species, USFWS, Washington, D.C.

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

FISH AND WILDLIFE SERVICE
WASHINGTON, D.C. 20240

ADDRESS ONLY THE DIRECTOR,
FISH AND WILDLIFE SERVICE

RD
DRD
AFF
AWR
AHR
LE
PAO
ESO
FILE SE
CL 10-196

End Sp. R-2
JOHNSON
Bowman
Burton
Curley
Halvorson
Hoffman
Lewis
PADILLA
Herp
Hoop
SANCHEZ
FILE

In Reply Refer To:
FWS/OES

OCT 15 1985

Memorandum

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

From: Acting Associate Director - Federal Assistance

Subject: Review of the Sneed Pincushion Cactus and Lee Pincushion Cactus Recovery Plan - Agency Draft

We have reviewed the subject plan and found the agency draft is much improved over the technical draft. Editorial comments are provided in the margins of the draft (attached). Specific comments are as follows:

1. Page 4. Distribution and Land Ownership. This section should contain references to the historical distribution of the two cacti. It should also reference if there are any areas from which the plants have been extirpated. If possible this section should give some indication of the relative abundance of the Sneed cactus on various lands, e.g., the largest known populations of Sneed cactus occurs on Guadalupe National Park (NP) and Carlsbad Caverns NP lands. A-1

2. Page 13. Impacts and Threats. On page 5 (first full paragraph) information is provided on the only known location of the Lee pincushion cactus (Carlsbad Caverns NP), the approximate size of the area in which it is found, and four references on the subject. Then on pages 15-17 (the Lee pincushion cactus section) more information is furnished, such as the name of the canyon area where the plant is found, mention of the loop road "where there is easy access," and other related information. Specific references should be deleted to reduce the chances of illegal collecting. A-2

3. Page 18. One of the suggested criteria for downlisting of the Sneed cactus is to have a "...known numbers of plants (of) at least 10,000." The technical draft estimated a population of over 100,000. Is the target of 10,000 reasonable? A second downlisting criteria makes reference to the known historic range of the plant. Is this identified in the plan? If not, please include. A-3 A-4

What is the objective for the Lee cactus? Is there a reason why the two subspecies should not have similar downlisting criteria? Please address this issue. A-5

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OCT 21 1985
OFFICE OF THE
REGIONAL DIRECTOR

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4. Page 24. Task 22. Since all of the known Lee cactus and most of the Sneed cactus are on Federal lands, this task may be the most important part of the plan. Accordingly, you have assigned a priority 1 to the task. To substantiate the high priority of this task, expand the task narrative. The narrative should contain sufficient detail to demonstrate that the task must be accomplished in the near future or the species may become extinct in the foreseeable future. A-6

5. Page 27. Task 32. This task calls for propagation and transplantation of the Lee pincushion cactus. What about the Sneed cactus? A-7

6. Page 30. Verify that the two following references are cited in the plan: Berger 1929 and Castether and Pierce 1966. A-8

7. Page 33. Recovery action priority 1. Add the following "... in the foreseeable future." A-9

8. Page 34. Implementation Schedule. Tasks should be included at the lowest assignable level, e.g., Task 11 should be listed as Task 111 and Task 112. A-10

   The following tasks are missing: 13, 21, 311, 312, and 313. As stated above, Task 31 should be included as Tasks 311-315.

We hope these comments will be helpful in development of the final plan. If you disagree with any of the above comments, please let us know before the plan is put in final draft. Please provide the Office of Endangered Species, 500 Broyhill Building, 25 copies of the plan once it has been approved and printed.

Thomas J. Parisot

THOMAS J. PARISOT

Attachment

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

End. Sp. R-2
JOHNSON
LANGOWSKI
Bowman
Burton
Carley
Halverson
Hoffman
Lewis
McDonald
Clwell
Steffend
Stout
PADILLA
Harp
Hopp
SANCHEZ
FILE

Reply To: 2670

Date: OCT 31 1985

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CL-11-28

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

Dear Mr. Spear:

We appreciate the opportunity to comment on the agency review draft recovery plan for the Sneed and Lee pincushion cacti. The plan was evaluated by Reggie Fletcher our Regional Botanist.

The Sneed and Lee pincushion cacti belong to a group of closely related cacti in Southern New Mexico and Southeastern Arizona. These cacti are controversial taxonomically and are usually endemic to isolated mountain ranges. They include Coryphantha (Escobaria is preferred by some cactophiles) orcuttii var. Koenigii, C. orcuttii var. macraxina, C. organensis, C. sandbergii, C. villardii, and C. robbinsorum. These plants are closely related to not only the Sneed and Lee pincushion cacti but C. strobiliformis, C. dasyacantha and C. duncanii. While taxonomic validity for several of these entities may be argued in cactus circles for some time to come, it is certain that some degree of distinctiveness has evolved due to geographic isolation of the various small mountain ranges in this area. B-1

The relationship between the Sneed and Lee pincushion falls into the same category. As study proceeded and knowledge of these plants expanded, we went from a known geographical range separation of slightly over 100 miles to the authors of the plan indicating the two grow nearly side by side in Carlsbad Caverns National Park. It is apparent the taxonomy of this entire group needs further study, particularly since C. robbinsorum has been proposed for Federal protection and several of the other members of the group may be nominated for such in the future. B-2

The Impacts and Threats section of our enclosed October 26, 1984, comments on the technical review draft of the recovery plan for these two cacti still applies. B-3

Page 10 of the plan covers population biology of the Sneed cactus. Our studies have shown that while flowering conditions are normally those reported in the plan, the Sneed cactus may bloom not only in the spring, but also during summer months. The cactus can bloom within 24 hours of a summer rain. Flowering during the summer appears to be tied to moisture following a dry period. The cactus may flower less during a consistently wet year than a dry one with intermittent rainfall. B-4

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When removed from their native habitats and grown together, C. strobiliformis has been shown to have the ability to flower during the same time period as the Sneed cactus. B-5

Birds have been noted to feed on the fruits of both the Sneed cactus and C. strobiliformis and are expected to serve as agents of dispersal at least occasionally. B-6

Fire relationships are mentioned several times in the plan. The Sneed cactus population on the Lincoln National Forest usually inhabits sites that either would be protected during a fire or that would burn lightly, or with what may be referred to as a cool burn. Cacti similar in form to the Sneed cactus have been found to succumb readily to fires of even moderate intensity. However, as previously stated, the large majority of the sites containing the Sneed cactus are at least partially protected from fires. The cactus does not do well with shrub overstory nor does it compete well with grass or other herbaceous vegetation. B-7

The Lincoln National Forest population is protected by both Forest Service regulations and the Endangered Species Act. In addition, the plant will be covered by the new Endangered plant law in New Mexico. This population was a closely guarded secret until a short time ago. To date, we have seen no evidence of unauthorized collection and the native habitat appears to be as fully stocked as can be expected under natural conditions. It remains to be seen whether future monitoring will detect illegal collection. B-8

The Lincoln National Forest population is in a remote location in rugged terrain. The area is minimally, if at all, utilized by livestock. Since the plant came to our attention, no activities have been planned by Forest Service personnel that have been found to be detrimental to the continued existence of the cactus. B-9

In order to contribute to the recovery process for the Sneed cactus, we have arranged to provide the New Mexico Nature Conservancy with a crop of these cacti resulting from a planting of 500 seeds. The seeds were obtained from nursery stock. B-10

We look forward to further cooperation with Fish and Wildlife personnel in the study and protection of this cactus.

Sincerely,

DAVID F. JOLLY
Deputy Regional Forester

Enclosure

cc:
WO, WL
R-3, WL
Paul Knight, NM Resource Survey
Fletcher

United States Department of the Interior

IN REPLY REFER TO
6840 (931)

BUREAU OF LAND MANAGEMENT
NEW MEXICO STATE OFFICE
P.O. BOX 1449
SANTA FE, NEW MEXICO 87501

End Sp. R-2	
✓	JOHNSON
	LANGOWSKI
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	Hopp
	SANCHEZ
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SEP 18 1985

Memorandum

To: Regional Director, Region 2, USFWS, Albuquerque, NM

From: Associate State Director, BLM, Santa Fe, NM

Subject: Agency Review Draft Recovery Plan for the Sneed and Lee Pincushion Cacti

Thank you for the opportunity to review the subject document.

Overall, the plan is well written and seems to provide guidance for eventual recovery of these species. We do have questions concerning the Impacts and Threats Section of Part One, specifically page 17, Animal Trampling.

The Lee Pincushion Cactus occurs only on Carlsbad Caverns National Park (CCNP). No domestic livestock are grazed on CCNP. Therefore, this trampling is being accomplished by wild grazing animals. How are populations of wild grazing animals proposed to be controlled? Which species of wild grazing animal is trampling the cactus? Perhaps this section of Part One can be clarified. C-1

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DEPARTMENT OF THE ARMY
HEADQUARTERS, US ARMY AIR DEFENSE ARTILLERY CENTER AND FORT BLISS
FORT BLISS, TEXAS 79916-5000

September 24, 1985

REPLY TO
ATTENTION OF

Directorate of
Engineering and Housing

End. No. R-2
JOHNSON
LANGOWSKI
Bowman
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Halverson
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Lewis
McDonald
Stafford
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SANCHEZ
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SG

Mr. Conrad Fjetland
Assistant Regional Director
Fish and Wildlife Service
P.O. Box 1306
Albuquerque, New Mexico 87103

Dear Mr. Fjetland:

Thank you for the apportunity to review the draft recovery plan for the Sneed pincushion cactus. I have several comments to make. In regards to a statement on page 15 that "some potential habitat on military land is presently used as an artillery impact area," I assume what is meant by potential is unoccupied, but possibly suitable. Note that the subject impact area has been surveyed twice and no cacti were located; it is rather doubtful that these surveys missed any populations. Second, the plan (page 15) states that this cactus usually grows on a south-facing exposure. The largest concentration on Fort Bliss is located on a northwest-facing slope, the other individuals on an east-facing slope. D-1 D-2

In the event you require further assistance, please feel free to contact us, in particular if access into the installation is required by your staff. Please call me at (915) 568-7930 or 568-5502.

Sincerely,

Kevin von Finger

Kevin von Finger
Ecologist

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TEXAS NATURAL HERITAGE PROGRAM

Garry Mauro
Commissioner
General Land Office

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December 1, 1985

Dr. Charles McDonald
Endangered Species Office
U.S. Fish and Wildlife Service
P. O. Box 1306
Albuquerque, New Mexico 87103

Dear Charlie,

Enclosed are a few comments on the agency review draft recovery plan for the Sneed and Lee pincushion cactus.

On pages 8 and 15, Sneed pincushion cactus is said to be restricted to Mississippian and Pennsylvanian limestone. However in Dr. Allan Zimmerman's recent dissertation on Coryphantha, he states that the Bishop's Cap Mountain population is on or within a few meters of Silurian-Ordovician-Cambrian limestone. The recovery plan should be amended to include all known substrates for Sneed pincushion cactus. E-1

Lyman Benson is misspelled as "Lymon" on page 3. E-2 On page 10, the flowering time of Sneed pincushion cactus is given as April. In Zimmerman's dissertation, he listed specimens collected in flower from April, July, and August. He believes that this uncharacteristic second blooming season occurs after summer rains. E-3 He states that the principal blooming season of Sneed pincushion cactus is in April, as should the recovery plan.

On pages 22 and 23, the monitoring of cactus and succulent trade shows is discussed. E-4 If the presence of agents is made known, it seems likely that no one would attempt to sell endangered species. Perhaps if the agents worked undercover, the sellers of endangered species could be caught and prosecuted which would be more of a deterrent.

Thank you for soliciting my review and comments.

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DEC 6 '85
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Sincerely,

Jackie

Jackie M. Poole
Botanist, Texas Natural Heritage Program

(512) 475-0660
Stephen F. Austin Building 1700 North Congress Austin, Texas 78701

United States Department of the Inte
NATIONAL PARK SERVICE
Carlsbad Caverns and Guadalupe Mountains National Parks
3225 National Parks Highway
Carlsbad, New Mexico 88220

IN REPLY REFER TO:

N1621

September 12, 1985

Memorandum

To: Regional Director, Southwest Region

From: ACTING Superintendent, Carlsbad Caverns and Guadalupe Mountains

Subject: Review comments for draft Recovery Plan for Sneed and Lee Pincushion Cacti

We appreciate the opportunity to provide comments for the above document and submit the following:

1. We find the plan to be generally well written and support recommendations concerning NPS protection and management of the listed cacti. F-1

2. While there is no question that the Sneed pincushion cactus should be protected by Federal land managers, we wonder if the relative abundance of this plant and the lack of threats potentially impacting it (as interpreted from pages 13 through 15) fully justifies the expenditure of the 3-year $104,000 budget identified in the plan. We would suggest that the establishment of delisting criteria be given a higher priority in the implementation schedule and that subsequent studies (population biology and fire ecology) be funded to support a more immediate consideration of downlisting, or even delisting, the cacti. Emphasizing this suggestion is our belief that NPS management policies now affords maximum protection to populations found within national park boundaries. F-2 F-3

Regardless of the above suggestion, please be assured of the park staff's cooperation in the protection of all listed species and in our appreciation of support we've received from Dr. Heil and Mr. Brack and from the offices of the U. S. Fish and Wildlife Service. F-4

Bobby L. Crisman

Bobby L. Crisman

TEXAS
PARKS AND WILDLIFE DEPARTMENT
4200 Smith School Road Austin, Texas 78744

CHARLES D. TRAVIS
Executive Director

End Sp. R-2
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October 23, 1985

Mr. Michael J. Spear, Regional Director
U. S. Fish and Wildlife Service
Post Office Box 1306
Albuquerque, New Mexico 87103

Dear Mr. Spear:

This is in response to your August 23, 1985 letter requesting this agency review the attached draft recovery plan for the Sneed and Lee pincushion cacti.

The plan appears well conceived; however, a number of minor changes should be made. These have been incorporated into the enclosed corrected draft. G-1

Thank you for allowing me to comment on this matter.

Sincerely,

Charles D. Travis
Executive Director

CDT:FEP:ic

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Responses to Comments

A-1 Information on present range, historic range, and abundance has been incorporated into the plan to the extent possible. Unfortunately, there are no estimates for the number of plants for most Sneed pincushion cactus populations. Estimates that have been made, such as for Carlsbad Caverns National Park, were not derived by quantitative sampling techniques so their accuracy is questionable.

A-2 References to the locality of the Lee pincushion cactus within Carlsbad Caverns National Park have been deleted.

A-3 The downlisting criteria for the Sneed pincushion cactus have been revised to clarify the need for at least six secure populations with a target of 20,000 total plants. However, the security and health of populations through the development and implementation of habitat management plans is considered more important than the precise number of plants. As mentioned in comment A-1, the estimate of 100,000 plants needs confirmation and, therefore, should not be used as a target number in establishing downlisting criteria.

A-4 Information on present and historic range for the cacti has been included in the Distribution and Land Ownership section of the plan.

A-5 Although the Sneed pincushion cactus is listed as endangered, the Lee pincushion is only listed as threatened. Downlisting criteria for the Sneed pincushion cactus are established in the plan, but more needs to be learned about the habitat and abundance of both cacti before delisting criteria can be established. The plan includes a task to establish delisting criteria.

A-6 The narrative for Task 22 has been expanded to emphasize the importance of management plans and to clarify their essential elements.

A-7 The number of presently known populations of the Sneed pincushion cactus makes it unlikely it will need management through propagation and transplantation. A statement to this effect has been included.

A-8 All references have been verified for their inclusion in the text.

A-9 Suggestion was incorporated.

A-10 Suggestion was ircorporated.

B-1 Comment noted.

B-2 Comment noted.

B-3 Those comments were addressed in revisions to the technical review draft.

B-4 Information was incorporated.

B-5 Comment noted.

B-6 Information was incorporated.

B-7 Comment noted.

B-8 Comment noted.

B-9 Comment noted.

B-10 Comment noted.

C-1 Deer are the principal grazing animals that could damage populations through trampling. Evaluation of impacts from animal trampling and possible methods of control, if necessary, are specific management activities that will be addressed in habitat management plans.

D-1 Suggestion was incorporated.

D-2 Information was incorporated.

E-1 Information was incorporated.

E-2 Correction was made.

E-3 Information was incorporated.

E-4 Suggestion was incorporated.

F-1 Comment noted.

F-2 Costs included in the implementation schedule are believed to be realistic estimates of the costs for full recovery of the Sneed and Lee pincushion cacti. If accomplishment of some tasks in the plan indicates other tasks are not needed, this and the resulting cost changes will be included in future revisions to the plan.

F-3 Criteria for delisting cannot be established until more is known about the management needs of these cacti. Tasks to gather this information such as studies of population biology and fire ecology must, therefore, be given higher priority than actual establishment of delisting criteria.

F-4 Comment noted.

G-1 Suggestions and information have been incorporated.