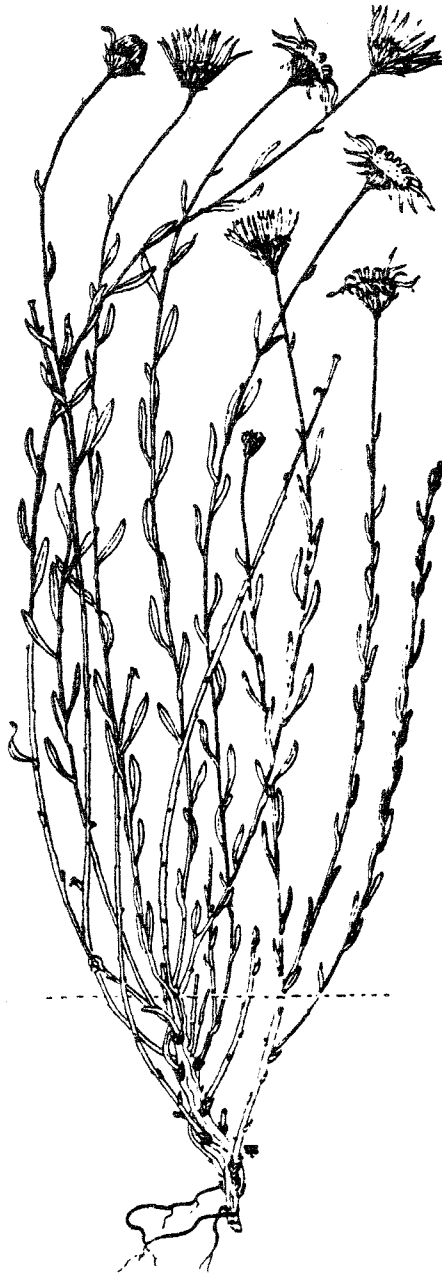


ZUNI FLEABANE

(*Erigeron rhizomatus*)

RECOVERY PLAN



U.S. Fish and Wildlife Service

Albuquerque, New Mexico

1988

RECOVERY PLAN FOR
ZUNI FLEABANE
(Erigeron rhizomatus Cronquist)

Prepared by:

Paul J. Knight

New Mexico Department of Energy, Minerals, and Natural Resources

Santa Fe, New Mexico

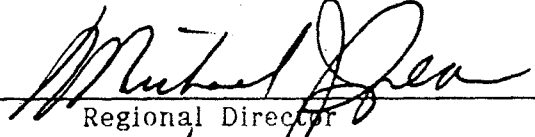
for

U.S. Fish and Wildlife Service, Region 2

Albuquerque, New Mexico

Reviewed and edited by:
Peggy Olwell

Approved:


Regional Director

Date:

9/30/88

DISCLAIMER

This is the completed Zuni Fleabane 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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6011 Executive Blvd.
Rockville, Maryland 20852
301/770-3000

1-800-582-3421

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SUMMARY

- GOAL:** To remove Zuni fleabane from the Federal list of endangered and threatened species by managing the species and its habitat so that the continued existence of self-sustaining populations in the wild will be ensured.
- RECOVERY CRITERIA:** The criteria for delisting the Zuni fleabane will be the completion of a survey of all potential habitat, the achievement of long term stability of this species demonstrated by continued monitoring, and the removal of the threat of future mineral exploration, leasing or development on this species' habitat.
- ACTIONS NEEDED:** The major steps needed to meet the recovery criteria include: remove threats by coordinating with the Bureau of Land Management and the U.S. Forest Service, enforce existing laws and regulations, assemble documentation on mineral potential or planned development, and develop a habitat management plan in cooperation with the involved agencies for the long-term protection of habitat; install permanent monitoring plots at population sites and initiate biological, ecological and geological studies of the species and its habitat to develop an understanding of the requirements needed to sustain healthy populations; and develop public support for the preservation of Zuni fleabane.

TABLE OF CONTENTS

DISCLAIMER.....	1
ACKNOWLEDGEMENTS.....	ii
SUMMARY	iii
PART I INTRODUCTION.....	1
Taxonomy.....	2
Morphology.....	3
Distribution.....	3
Habitat.....	5
Associated Species.....	8
Population Biology.....	10
Land Ownership.....	10
Impacts and Threats.....	11
Legal Protection.....	12
PART II RECOVERY.....	14
Objective.....	14
Step-Down Outline.....	14
Narrative.....	17
Literature Cited.....	27
PART III IMPLEMENTATION SCHEDULE	29
APPENDIX	33
List of Reviewers	33
Comments Received	34
Response to Comments	38

PART I

INTRODUCTION

The Zuni fleabane, Erigeron rhizomatus Cronquist, was listed as a threatened species on April 24, 1984 (USFWS 1984). The species is known from west-central New Mexico, where it occurs in scattered populations in the Zuni, Datil, and Sawtooth Mountain ranges. Dr. Rupert Barneby collected the type specimen on May 16, 1943. Barneby's field notes state "on detrital clay bank, somewhat alkaline; canyon south of Fort Wingate, McKinley County, New Mexico, 7,400 feet." Specifically, the type locality is 1 mile south of the Fort Wingate boundary, in the Zuni Mountains of McKinley County, New Mexico. Twelve populations are known; 11 of these occur on lands managed by the U.S. Forest Service. The remaining population occurs on lands administered by the Bureau of Land Management (BLM).

Many members of the genus Erigeron, including the Zuni fleabane, are rare and highly endemic. Presently, 50 members of this genus are listed in the 1985 notice of review (USFWS 1985) as candidates for listing. One species, Erigeron maguirei var. maguirei, is currently listed as endangered.

Erigeron rhizomatus is threatened by modification of its habitat due to mineral exploration and development (Fletcher 1978). The distribution of Zuni fleabane is geologically associated with the distribution of uranium deposits in west-central New Mexico. Any significant development of these deposits would

seriously jeopardize the Zuni fleabane and probably prompt reclassification from threatened to endangered.

This plan outlines the steps necessary to achieve and document long-term stability of Zuni fleabane populations by removing and preventing threats to the species and its habitat. Attainment of these goals will lead to the ultimate objective of removal of the Zuni fleabane from the Federal list of endangered and threatened species.

Taxonomy

Erigeron rhizomatus was first collected by Dr. Rupert Barneby on May 16, 1943 (holotype at New York Botanical Gardens). The specimen was collected on a bank of red detrital clay just south of Fort Wingate in McKinley County, New Mexico. The material was forwarded to Dr. Arthur Cronquist of the New York Botanical Garden, who identified it as a new species and subsequently described it in *Brittonia* on May 26, 1947. The name, E. rhizomatus, was derived from its subterranean stem, which has the form of a creeping rhizome. Dr. Cronquist (1947) felt that the Zuni fleabane was anomalous because, although the species clearly belonged to the section Wyomingia of the genus Erigeron, it did not seem to be closely related to any other known species. However, the subglabrous leaves and involucre of E. rhizomatus separate it from other species in the section, and its peculiar growth habit is unique in the genus.

Morphology

The Zuni fleabane is a perennial herb, arising from ascending or upright subterranean stems (rhizomes). The stems are erect, numerous, and strigose. The flowering stems are sparsely leafy, while the sterile ones are densely leafy. Leaves are less than 1 cm long (0.4 inches), oblong, and glabrous except for occasional ciliate hairs on the margins. The flower heads are solitary on the branches, 13-16 mm (0.6-0.7 inch) wide, with the involucre bracts in several series. Each head has 25-45 pale blue ray flowers that are 6-7 mm (0.25 inch) long and 1.3-1.5 (0.07 inch) wide. The disk flowers are yellow. The achenes (seeds) are glabrous, with a pappus of 25-30 conspicuous bristles and a few inconspicuous setae (Cronquist 1947).

Past and Present Distribution and Abundance

Zuni fleabane is found only on fine textured clay hillsides of mid to low elevation mountain slopes in McKinley and Catron Counties, New Mexico. Specifically, the species occurs in highly localized population sites in the Zuni, Datil, and Sawtooth Mountains of west-central New Mexico (Figure 1). It is restricted to clays of the Chinle Formation in the Zuni Mountains, and to similar clays of the Baca Formation in the Datil and Sawtooth ranges (Fletcher, U.S. Forest Service, Region 3, pers. comm., 1986). The sites in the Zuni Mountains are confined to two localized areas, each no greater than 2.4 kilometers (1.5 miles) across. These locales probably account for less than 20 percent of the total number of Erigeron rhizomatus plants. The Datil and Sawtooth Mountain populations are considerably larger than the populations in the Zuni Mountains, and

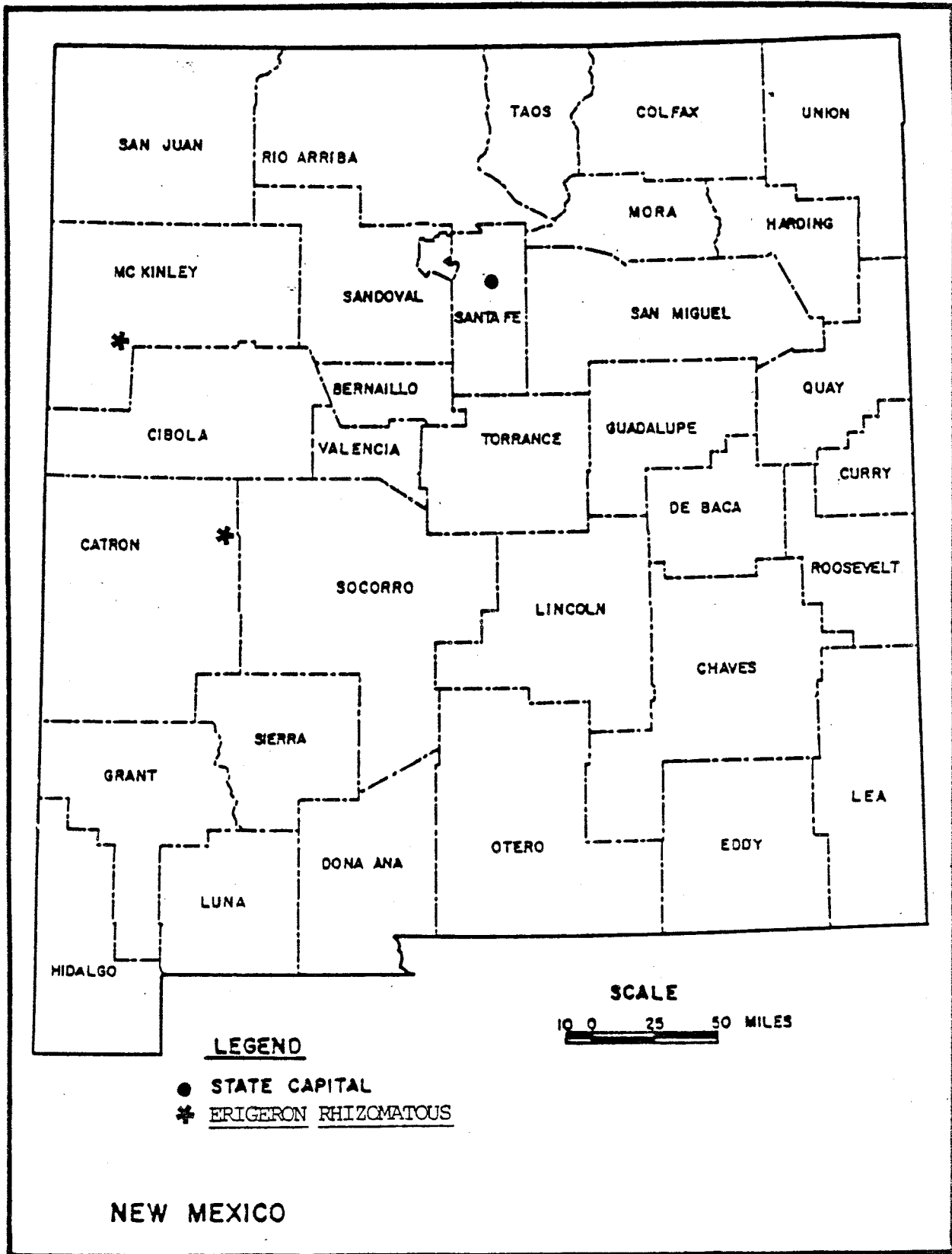


Figure 1. Distribution of Erigeron rhizomatous

occur in bands corresponding to specific outcrops of the Baca Formation stretching from Red Canyon in the Datils, westward for approximately 19.3 kilometers (12 miles) to the center of the Sawtooth Mountains (Fletcher, pers. comm., 1986). This band rarely exceeds 3.2 kilometers (2 miles) in width. Segregation into distinct populations is somewhat artificial since gene flow of some extent can be expected throughout most of these bands.

Twelve sites have been located. Three sites occur in the Zuni Mountains, five occur in the Datil Mountains, and four occur in the Sawtooth Range. Accurate counts of individuals and density are not yet available for these sites. Counts of individual plants are difficult because of their diffuse distribution and because the Zuni fleabane is rhizomatous and it is difficult to distinguish individual plants from members of a clone group. A list of known occurrences is presented in Table 1.

Habitat

The Zuni fleabane is found on a red detrital clay derived from the Chinle or Baca Formations. Erigeron rhizomatus in the Zuni Mountains grows on clay substrate of Chinle origin, which was deposited during the Mesozoic Era. However, the Datil and Sawtooth Mountains populations are on the Baca Formation, a structurally similar red-bed clay of Eocene-Oligocene origin. Lucas (1983) delineated the distribution of the Baca Formation and the Eocene-Oligocene boundary in west-central New Mexico. Although the Baca and Chinle Formations are of radically different temporal origins, they may be related in their fundamental composition. Cather (1983) has clearly demonstrated that the Baca

TABLE 1. OCCURRENCE AND OWNERSHIP OF POPULATION SITES*

SITE NAME	SITE LOCATION	OWNERSHIP
1. TYPE LOCALITY	ZUNI MTS.	U.S. FOREST SERVICE
2. SIX MILE CANYON A	ZUNI MTS.	U.S. FOREST SERVICE
3. SIX MILE CANYON B	ZUNI MTS.	U.S. FOREST SERVICE
4. WHITE MESA	DATIL MTS.	U.S. FOREST SERVICE
5. REMUDA CANYON	DATIL MTS.	U.S. FOREST SERVICE
6. PINE CANYON	DATIL MTS.	U.S. FOREST SERVICE
7. WHITE DEER OVERLOOK	DATIL MTS.	U.S. FOREST SERVICE
8. OX SPRING CANYON WEST	SAWTOOTH MTS.	U.S. FOREST SERVICE
9. OX SPRING CANYON EAST	DATIL MTS.	U.S. FOREST SERVICE
10. SUNFLOWER FLATS SOUTH	SAWTOOTH MTS.	BLM
11. MIDDLE SAWTOOTH MTS.	SAWTOOTH MTS.	U.S. FOREST SERVICE
12. NORTH SAWTOOTH MTS.	SAWTOOTH MTS.	U.S. FOREST SERVICE

*Fletcher (1986)

Formation in Catron County is the result of fluvial deposition of reworked sedimentary strata eroded from sedimentary rocks north and west of the Datil Range. The Baca Formation in the Datil and Sawtooth Mountains is probably the product of reworked Chinle material carried in from the north and west during fluvial and lacustrine activities in the late Eocene. If so, it is likely that the Baca Formation is chemically similar to the Chinle. Erigeron rhizomatus is found where these formations are in the process of decay, resulting in the formation of a steep, easily erodible slope that does not crust over. Occasionally, some plants will develop on soils where a surface has formed, but the bulk of the populations prefer the coarse particulate material that is little degraded from the parent rock (Fletcher 1978, Wagner and Sabo 1977). Reggie Fletcher (pers. comm., 1986) describes the habitat as reminiscent of the marginal Painted Desert in Arizona. He also states that although some of the Zuni plants are found in adjacent sandy washes, they do not occur any distance from the parent population, and do not tolerate any degree of competition. Erigeron rhizomatus is found in an elevational range of 2230-2440 meters (7,300-8,000 feet) in the pinyon-juniper association. The species prefers slopes of up to 40 degrees, usually with a north-facing aspect, but it also occurs on eastern and western exposures. It never occurs on slopes with a southern aspect. The Zuni fleabane occurs in an area that receives between 36-40 cm (14-16 inches) of rainfall a year, with approximately 120-140 days a year without a killing frost. The last killing frost in the spring occurs on about May 20, and the first killing frost in the fall occurs on about September 25 (Tuan et al. 1973).

Associated Species

The Zuni fleabane is found in the pinyon-juniper woodland. The overall vegetative cover is usually high, but the specific microhabitat on which the fleabane occurs is sparsely vegetated. Erigeron rhizomatus is often directly associated with Astragalus accumbens (another rare species restricted to west central New Mexico). A partial list of species in association with Erigeron rhizomatus follows (Martin and Hutchins 1980, Sabo 1982, Fletcher 1978):

TREES

Fraxinus cuspidata (fragrant ash)

Juniperus monosperma (oneseed juniper)

Pinus edulis (pinyon pine)

Quercus gambellii (Gambel's oak)

SHRUBS

Atriplex canescens (four wing saltbush)

Cercocarpus montanus (mountain mahogany)

Chrysothamnus depressus (dwarf rabbitbrush)

Chrysothamnus nauseosus ssp. pinifolius (rubber rabbitbrush)

Cowania stansburiana (cliff' rose)

Gutierrezia sarothrae (broom snakeweed)

Lycium pallidum (pale wolfberry)

Yucca angustissima (narrowleaf yucca)

SUBSHRUBS AND HERBACEOUS PLANTS

- Asclepias asperula (milkweed)
- Astragalus accumbens (Zuni milkvetch)
- Astragalus albulus (Cibola milkvetch)
- Astragalus kentrophyta var. neomexicanus (spiny-leaf milkvetch)
- Calochortus nuttallii var. aureus (mariposa lily)
- Crypthantha jamesii (James' hiddenflower)
- Eriogonum jamesii var. jamesii (wild buckwheat)
- Eriogonum leptophyllum (narrowleaf buckwheat)
- Euphorbia fendleri (spurge)
- Hymenopappus fillifolius var. cinereus (white-ragweed)
- Hymenoxys richardsonii var. floribunda (pingue)
- Leucelene ericoides (white aster)
- Mirabilis spp. (wild four o'clock)
- Oxytropis lambertii (Lambert's crazyweed)
- Petalostemum candidum (white prairie clover)
- Psilostrophe tagetina var. lanta (paperflower)
- Solidago graminifolia (goldenrod)
- Sphaeralcea coccinea var. dissecta (globemallow)
- Wyethia scabra (wyethia)

GRASSES

- Bromus frondosus (weeping brome)
- Hilaria jamesii (galleta grass)
- Koeleria cristata (Junegrass)
- Oryzopsis hymenoides (Indian ricegrass)

Oryzopsis micrantha (littleseed ricegrass)

Sporobolus flexuosus (mesa dropseed)

Population Biology

Erigeron rhizomatus is known from 12 localities in west central New Mexico. The density of these populations can vary dramatically along the course of their distribution. Some locations are typified by a handful of isolated plants, while other locales may have dense localized clusters of plants. The Zuni fleabane generally flowers from mid to late May into early June. Fruiting time varies from mid June to early July. The mature seeds fall by the end of July. Population sites are typically low in coverage of associated species. The core of most of the population sites is centered on loose, non-crusted soil on slopes of 20-40 percent. Population margins occur where the red-bed clay soils thin out and disperse into adjacent soil types. Although young plants are usually present, the majority of the populations are composed of mature plants tightly grouped into rhizomatous clones. The highly eroded nature of the habitat would suggest that reproduction by seeds is probably infrequent. Most seedlings are probably washed away before they have time to become established. Most propagation probably occurs as the result of the spread of rhizomes and the subsequent development of aerial plant parts.

Land Ownership

All known Zuni fleabane population sites occur on public lands. Eleven of the 12 known sites occur on lands managed by the U.S. Forest Service in the Cibola National Forest. The remaining site is on land administered by the Bureau

of Land Management. This small isolated locale is situated at the northern end of the Sawtooth Mountains.

Impacts and Threats

The major threat to Erigeron rhizomatus is the surface disturbance activity associated with mineral development. On Zuni fleabane habitat, uranium is the primary mineable resource. Many, if not most, of the Zuni fleabane sites are directly associated with historic or current mining claims for uranium. At present, the world glut in uranium has depressed the market, making the mining of these resources non-profitable. However, world market demands may change in the future and make the prospect of mining these uranium deposits not only profitable but attractive to mine promoters and developers. This activity would cause direct conflict with the survival of Erigeron rhizomatus and would certainly elevate the species to endangered status. The removal of this mining threat is paramount to the recovery of the Zuni fleabane.

Habitat disturbance by off-road vehicles is not, at present, a threat to the Zuni fleabane. However, off-road vehicle (ORV) activities are becoming increasingly more popular and are a potential threat to the fragile habitat of this species.

The Zuni fleabane appears to be unaffected by livestock grazing. Possibly, this species is not grazed because it may concentrate some toxic element such as selenium, rendering it unpalatable to most herbivores. However, indirect effects of grazing, such as erosion of the habitat, are a threat. Some seedlings and young plants are probably destroyed by erosion.

Presently, there is no data to suggest that acid rain or acidic dry deposition pose any threat to the Zuni fleabane. However, with the proliferation of power-plants in the southwest United States and the construction of ore smelters in northern Mexico, the increasing particulate and chemical fallout may have an effect on this species.

Natural factors could also contribute to mortality. However, no damage to plants by rodents or insects has been documented.

Legal Protection

Erigeron rhizomatus is on the New Mexico State Endangered Plant Species list, Section 1; a new Section 9-10-10 NMSA 1978. This Act protects listed species of plants by prohibiting taking, possessing, transporting, exporting from the State, processing, selling or offering for sale or shipment within the State of New Mexico of listed plants or plant materials. However, listed species can be collected through issuance of a permit for scientific study or educational purposes. Plants from known population sites cannot be collected without prior approval of a research design from New Mexico Department of Energy, Minerals, and Natural Resources.

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

plant species. Under certain circumstances, the Act also provides for the issuance of permits to carry out otherwise prohibited activities involving listed species. The Endangered Species Act provides additional protection for Erigeron rhizomatus through Section 7 (interagency cooperation) requirements.

The Lacey Act, as amended in 1981, also provides protection for the Zuni fleabane. This Act prohibits the import, export, sale, acquisition, purchase, or interstate or foreign commerce of any plant taken, possessed, or sold in violation of any law, treaty, or regulation of the United States, any Indian tribal law, or any regulation of any State.

Erigeron rhizomatus is also on the U.S. Forest Service Sensitive Plant list which prohibits taking of this species in the Cibola National Forest. A permit must be obtained from the Forest Service for collection.

PART II

RECOVERY

Objective

The main objective of this recovery plan is to protect Erigeron rhizomatus and manage its habitat so that healthy populations can be sustained in their natural habitats. To meet these objectives and to delist the Zuni fleabane the following actions are required:

1. Complete a survey of all potential habitat of Zuni fleabane.
2. Develop and implement a habitat management plan and install permanent monitoring plots within several populations of the Zuni fleabane.
3. A demonstrated long-term stability (or increase) in population levels and habitat from the monitoring plots, and a continued assurance that the habitat of Zuni fleabane will not be threatened by mineral exploration, leasing, or development.

Upon attainment, these criteria are to be evaluated for adequacy prior to delisting.

Step-Down Outline

1. Protect existing populations of Erigeron rhizomatus by removing threats to the species and by managing its habitat.

11. Enforce existing laws and regulations.
12. Document and assess the potential for mineral and other types of development on or near population sites.
 121. Document the existing mineral leases and prepare an assessment of the mineral development potential on or near population sites.
 122. Make an assessment of any other potential development in the area.
13. Develop a cooperative agreement between the Bureau of Land Management (BLM) and the U.S. Fish and Wildlife Service for the withdrawal of Erigeron rhizomatus habitat from future mineral exploration, lease or development.
14. Develop a cooperative agreement between the U.S. Forest Service and the U.S. Fish and Wildlife Service to monitor Erigeron rhizomatus habitat and populations.
 141. Monitor impacts of mineral exploration or development, ORV use, and natural or other events that would adversely affect the Zuni fleabane.
 142. Establish monitoring plots to determine the effect of dry acid deposition or acid rain on the Zuni fleabane.
 143. Establish monitoring plots to gather biological and demographic data on the Zuni fleabane.
15. Develop and implement a habitat management plan to protect Erigeron rhizomatus and its habitat.
 151. Develop guidelines for mineral development adjacent to Erigeron rhizomatus population sites.

- 152. Develop guidelines for regulating off-road vehicle access to Zuni fleabane habitat.
 - 153. Develop guidelines for right-of-way placements on Zuni fleabane habitat.
2. Study populations in their natural habitat.
- 21. Study the ecological requirements of the Zuni fleabane.
 - 211. Study the soil requirements and assess the effect of acid rain and/or dry acid deposition on the soil.
 - 212. Study the water needs of the Zuni fleabane.
 - 213. Study the role of biotic factors in the Zuni fleabane's ecology.
 - 2131. Pollinators.
 - 2132. Seed predators and dispersers.
 - 2133. Other organisms.
 - 214. Study the geology of the Zuni fleabane habitat.
 - 22. Study the population biology of the Zuni fleabane.
 - 221. Life history requirements.
 - 222. Demographic variation.
 - 23. Conduct an inventory of all suitable habitat of the Zuni fleabane.
 - 24. Apply the results of studies undertaken in tasks 14, 21, 22, and 23 to revise the habitat management plan.
3. Conduct laboratory studies on the Zuni fleabane.
- 31. Seed biology.
 - 32. Chemical analysis of tissue.
4. Develop public awareness, appreciation, and support for the preservation of Zuni fleabane.

Narrative

1. Protect existing populations of Erigeron rhizomatus by removing threats to the species and by managing its habitat.

The Zuni fleabane should be protected by controlling the impact of development on existing population sites and enforcing existing laws, and through careful monitoring of populations to detect change in demography or biology.

11. Enforce existing laws and regulations.

Existing laws and regulations, including the Endangered Species Act, the New Mexico Rare Plant Act, the U.S. Forest Service Sensitive Plant list, and the Lacey Act, need to be enforced.

12. Document and assess the potential for mineral and other types of development on or near population sites.

An in-depth field evaluation and a study of all types of potential development should be undertaken for all areas on and adjacent to Zuni fleabane locations.

121. Document the existing mineral leases and prepare an assessment of the mineral development potential on or near population sites.

Study all lease records and document existing uranium or other mineral leases on and adjacent to Zuni fleabane sites. Prepare a detailed report on the potential for uranium or other mineral development or exploration on and around Zuni fleabane sites.

122. Make an assessment of any other potential development in the area.

Assess and document the potential for other forms of development near Zuni fleabane sites. Possible types of development could include rights-of-way, powerline or gas line routes, access roads, and recreational development.

13. Develop a cooperative agreement between the Bureau of Land Management (BLM) and the U.S. Fish and Wildlife Service for the withdrawal of Erigeron rhizomatus habitat from future mineral exploration, lease or development.

To facilitate the management and protection of this species, a memorandum of understanding between the BLM and the Fish and Wildlife Service should be developed. This agreement should set forth the objective that Erigeron rhizomatus habitat will be removed from any future lease, exploration, or development for mineral resources. The U.S. Forest Service should participate in the withdrawal process.

14. Develop cooperative agreement between the U.S. Forest Service and the U.S. Fish and Wildlife Service to monitor Erigeron rhizomatus habitat and populations.

To assure the long-term protection and stability of the Zuni fleabane, a memorandum of understanding between the U.S. Forest Service and the U.S. Fish and Wildlife should be developed to institute a program of continued monitoring to detect any negative effects to the populations.

141. Monitor impacts of mineral exploration or development, ORV use, and other events that would adversely affect the Zuni fleabane.

Provide for periodic monitoring of past and current mineral exploration or development to determine the effect such activity has had on the Zuni fleabane. Also, monitor any ORV activity or natural events that might affect this species.

142. Establish monitoring plots to determine the effect of dry acid deposition or acid rain on the Zuni fleabane.

Acidic deposition is becoming a world-wide problem. With the proliferation of powerplants and ore smelters in the southwest United States and northern Mexico, acidic deposition is becoming a problem in the region. Monitoring plots should be established to determine if any negative changes due to acidic deposition occur in Zuni fleabane populations.

143. Establish monitoring plots to gather biological and demographic data on the Zuni fleabane.

Presently, little is known about the demography or population biology of this species. Such information is crucial in understanding the effects of habitat disturbances. Consequently, plots should be established and plants monitored to determine the structure and demography of the populations.

15. Develop and implement a habitat management plan to protect *Erigeron rhizomatus* and its habitat.

The habitat management plan should include guidelines for the protection of the Zuni fleabane. These guidelines should identify site-specific methods for reduction and prevention of habitat destruction of the Zuni fleabane. This plan should also develop guidelines for current mineral exploration or mining activities to reduce their impact on *Erigeron rhizomatus*.

151. Develop guidelines for mineral development adjacent to *Erigeron rhizomatus* population sites.

In some cases, mineral development on or adjacent to Zuni fleabane sites may be unavoidable. In such situations, guidelines should be developed to minimize the effect of such activities. These guidelines should address the placement of adits, access roads, and processing facilities.

152. Develop guidelines for regulating off-road vehicle access to Zuni fleabane habitat.

Off-road vehicle activity is rapidly becoming a major environmental problem in the western United States. Using off-road vehicles on Zuni fleabane habitat would almost certainly hasten the erosion of this fragile environment. Guidelines for restriction of ORVs on this habitat should be developed.

153. Develop guidelines for right-of-way placements on Zuni fleabane habitat.

The future needs of highways, powerlines, gas lines, and other projects requiring the acquisition of rights-of-way are difficult to anticipate. Regardless, guidelines for right-of-way placements on Zuni fleabane habitat need to be developed.

2. Study populations in their natural habitat.

Because of the rarity of Zuni fleabane, existing populations must be sustained in a healthy and vigorous state. To achieve and sustain this state, an in-depth understanding of the biology and ecology of the species and its geologic and habitat preferences needs to be developed. This understanding will help to better delineate its potential habitat.

21. Study the ecological requirements of the Zuni fleabane.

Implement studies to define and better understand the habitat requirements of Zuni fleabane. These requirements include soil, water, geologic, climatic, and interactive factors.

211. Study the soil requirements and assess the effect of acid rain and/or acidic dry deposition on the soil.

Zuni fleabane is restricted to a highly specific substrate. Indications are that some property of the soil may be responsible for this specificity, and studies are needed to understand this relationship. Studies will include soil tests for total nitrogen, pH, particle size, and cation exchange capacity. Additionally, the samples should be

tested for the presence of trace metals such as selenium and rubidium. When the results of these chemical analyses are available, the effect of acidic deposition on the soil can be evaluated.

212. Study the water needs of the Zuni fleabane.

Success of the Zuni fleabane depends on the amount and seasonality of rainfall. However, these moisture requirements are poorly understood. The effect of erosion and fluvial deposition on this species is also uncertain. These factors need to be investigated to develop better understanding of the dynamics of this species.

213. Study the role of biotic factors in the Zuni fleabane's ecology.

External biotic factors such as seed predators, pollinators, competitors, and herbivores affect most species. The effects of such factors on the Zuni fleabane should be studied.

2131. Pollinators.

Presently, it is uncertain which pollinators are more important in the Zuni fleabane reproductive cycle. This information is necessary to evaluate whether spraying of insecticides may impact the Zuni fleabane.

2132. Seed predators and dispersers.

Although many insects and some mammals and birds prey on the seeds of vascular plants, they may also play an important role in seed dispersal. These predators often can

have significant effects on the reproductive success of their prey species. A study of the potential effect of seed predators on this species is needed.

2133. Other organisms.

The restriction of the Zuni fleabane to a specific substrate may be due to the presence of root organisms (i.e. mycorrhizal fungi, nodulating bacteria) that form critical symbiotic relationships with the fleabane. These symbiotic relationships may influence the distribution of the Zuni fleabane to a greater degree than specific edaphic characteristics. To determine the existence and/or importance of symbiotic organisms, roots should be examined and organisms and relationships should be identified.

It is quite possible that the Zuni fleabane is restricted to the sparsely vegetated microhabitat of the Baca and Chinle clays because it is unable to tolerate competition in the other, more densely vegetated, microhabitats. Therefore, competitive relationships need to be studied in the field with other biotic effects.

214. Study the geology of Zuni fleabane habitat.

The Zuni fleabane is restricted to very distinct clay soils. The specificity of the Zuni fleabane to these soil types and the relationship between the two parent formations (Chinle and Baca) need

to be understood before a clear picture of its habitat requirements can be assembled. A geological field analysis should be conducted to compare the Baca and Chinle Formations and determine the similarities between them.

22. Study the population biology of the Zuni fleabane.

The life history of the Zuni fleabane should be studied because it reflects the taxon's adaptation to its environment. The preference of this species for highly eroded clay slopes indicates that there are characteristics of the microhabitat that are essential to its survival. These characteristics can modify plant productivity, fecundity, and survival. Adaptation to such an unusual microhabitat can confer a selective advantage to the Zuni fleabane over other species that are not as specifically adapted. Studies of subpopulations can identify the abiotic and biotic components that are essential to the success and survival of the taxon.

221. Life history requirements.

Some factors to be studied are seed germination requirements, seedling establishment, seedling survival and growth rate in varying microhabitats, the level of variation in anthesis, the success rate of pollination, the level of seed set and fruit development, and the mode and method of seed dispersion.

222. Demographic variation.

Natural populations fluctuate in their numbers and density in cyclical variation. Whether such cycles exist for the Zuni fleabane needs to be determined.

23. Conduct an inventory of all suitable habitat of the Zuni fleabane.

A survey of all potential habitat of Zuni fleabane needs to be conducted before we can fully assess and direct the needs and goals of a habitat management plan. Several areas of newly discovered potential habitat remain virtually unexplored, and discoveries of additional population sites in this area could change the course of the recovery effort. There are several areas of potential habitat on the Navajo Indian Reservation and these need to be inventoried. Also, the Baca Formation areas north of Quemado, New Mexico, including the northeast edge of Tejana Mesa and Mesa Tinaja, should be surveyed.

24. Apply the results of studies undertaken in tasks 14, 21, 22, and 23 to revise the habitat management plan.

As data become available from monitoring plots, from the ecological and biotic studies, from the population biology studies, and from the field inventories, it may become apparent that aspects of the initial management plan are not the most effective way to recover the species. If this is the case, the management plan should be revised to reflect the new information obtained.

3. Conduct laboratory studies on the Zuni fleabane.

To gain a better understanding of the biology of the Zuni fleabane, certain aspects of the species' growth and development need to be examined.

31. Seed biology.

A study of the seed biology of the Zuni fleabane should be undertaken. This study should include germination requirements, vernalization, dormancy, and the potential for anti-herbivory compounds in the seed.

32. Chemical analysis of tissue.

Several seasons of field study of the Zuni fleabane (Fletcher 1986) did not reveal any indication of foliage herbivory. A tissue analysis of the foliar material should be conducted to determine the presence of anti-herbivory compounds (e.g. alkaloids). This information will be useful in determining the seriousness of herbivory, and may supply important information on allelopathic methods of reducing herbivory.

4. Develop public awareness, appreciation, and support for preservation of Zuni fleabane.

Education of the public can be a vital part of the recovery of a species. The cooperation of the public can be essential for the ultimate success of ongoing recovery measures. Many public interest groups, such as native plant societies and The Nature Conservancy, can lend physical support to recovery efforts and aid in the management of habitat for the species.

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PART III

IMPLEMENTATION SCHEDULE

The Implementation Schedule that follows outlines actions and costs for the Zuni fleabane recovery program. It is a guide for 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), the responsible agencies, and lastly, estimated costs for FWS tasks. These actions, when accomplished, should bring about the recovery of Zuni fleabane and protect 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 this plant.

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. Management agreement
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
 OSM - USDI Office of Surface Mining
 FS - USDA Forest Service
 NM - State of New Mexico
 NN - Navajo Nation

PART III - IMPLEMENTATION SCHEDULE

General Category	Plan Task	Task #	Priority #	Task Duration	Responsible Agency			Fiscal Year Costs (EST) *			COMMENTS
					FWS		Other	FY 1	FY 2	FY 3	
					Region	Program					
02	Enforce existing regulations	11	1	Ongoing	2	SE	FS BLM NM	Existing funds			
I4	Document and assess mineral potential	12	2	3 years			FS BLM OSM				
A3	Develop cooperative agreements between FWS, BLM, and FS	13 14	2	1 year	2	SE	BLM FS	1,000			
A3	Monitor populations and habitat	141 142 143	2	Ongoing	2	SE	BLM FS	1,500	1,500	1,500	
M3	Develop and implement a habitat management plan	15	2	Ongoing			BLM FS				
R3	Study ecological requirements	21	2	3 years		SE		20,000	5,000	5,000	
R1, R6	Study population biology	22	2	5 years	2	SE		20,000	5,000	5,000	
I1	Inventory potential habitat	23	2	2 years	2	SE	BLM FS NN	15,000	10,000	10,000	

*Costs refer to USFWS expenditures only.

PART III - IMPLEMENTATION SCHEDULE
(continued)

General Category	Plan Task	Task #	Priority #	Task Duration	Responsible Agency			Fiscal Year Costs (EST)*			COMMENTS
					FWS		Other	FY 1	FY 2	FY 3	
					Region	Program					
I4	Apply results of ecology and population biology studies.	24	2	Ongoing	2	SE		2,000	2,000	2,000	
I3	Study seed biology and plant tissue	31	2	2 years	2	SE		10,000	10,000		
O1	Develop public awareness and support	4	3	Ongoing	2	SE		5,000	1,000	1,000	

*Costs refer to USFWS expenditures only.

APPENDIX

List of Reviewers

A technical/agency review draft of the Zuni Fleabane Recovery Plan was sent to the following individuals and agencies on December 9, 1986.

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

Mr. Sotero Muniz, U.S. Forest Service, Albuquerque, N M

Field Supervisor, Ecological Services, USFWS, Albuquerque, NM

Assistant Regional Director, Law Enforcement, USFWS, Albuquerque, NM

Dr. Richard Spellenberg, NM State University, Las Cruces, NM

Mr. Paul Knight, NM Dept. of Natural Resources, Santa Fe, NM

Ms. Anne Cully, NM Dept. of Natural Resources, Santa Fe, NM

Mr. Gerard Hoddenbach, National Park Service, Santa Fe, NM

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

Mr. Brian Mills, Bureau of Land Management, Santa Fe, NM

Ms. Donna House, Navajo Natural Heritage Program, Window Rock, AZ

Mr. John Egbert, The Nature Conservancy, Albuquerque, NM

Dr. Frank Thibodeau, The Center for Plant Conservation, Jamaica Plain, MA

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

Director (WR), Division of Research, USFWS, Washington, D.C.

Comments Received

Comment letters are reproduced in this section followed by the Service's response to each comment. Some reviewers submitted comments marked directly on the draft plan or submitted comments by phone. These comments have not been reproduced.



Mr. Michael Spear

2

While the biological studies recommended in the plan would provide nice-to-know information, they are not necessary in order to recover the species. The populations of E. rhizomatus are currently stable and healthy, but most sites have the potential of being disturbed to some degree by uranium mining or exploration activities. Protection of a significant percent of the known E. rhizomatus sites from these activities is necessary to qualify the plant for delisting.

A-6

We appreciate the opportunity to comment on the Draft Recovery Plan for E. rhizomatus and look forward to a continued close working relationship aimed at recovering the species.

Sincerely,

David F. Jolly
DAVID F. JOLLY
Deputy Regional Forester

cc:
Director, Wildlife
Cibola NF
Fletcher



Responses to Comments

A-1 Comment noted.

A-2 Comment incorporated.

A-3 Comment incorporated.

A-4 The Service agrees that a significant portion of the occupied habitat of Erigeron rhizomatus must receive permanent protection from mining and mineral exploration. However, before determining how much habitat and what habitat can be lost, a careful evaluation of the populations and habitat is necessary to maintain maximum variability within the species. Therefore, an amount of habitat will not be delineated in the objective section until documentation occurs.

A-5 Comment incorporated.

A-6 Field studies conducted by NM Department of Energy, Minerals, and Natural Resources personnel have indicated a low rate of reproduction from seed and the majority of individuals are mature clonal plants. We do not have the data to know how critical the clonal nature of the species is to population maintenance. An understanding of why the species is rare is necessary to recover the species.

B-1 Comment incorporated.

B-2 Comment incorporated.

B-3 Comment incorporated under Task 23.

B-4 Comment noted.