Erigeron rhizomatus

Survey and Status Report

for The Navajo Nation

Summer 2004

Kyle Christie

Deliverables

1. A written report of the status and abundance of *Erigeron rhizomatus* on the Navajo Nation. **Included here.**

2. A digital version of the written report and a digital version of all associated photographs. **Included here.**

3. Voucher specimens for each newly discovered population of *Erigeron rhizomatus* on the Navajo Nation. **Distributed directly to the Navajo Natural Heritage Program (NNHP).**

3. Voucher collections for all associated vegetation collected on the Navajo Nation during the duration of the survey. **Distributed directly to the NNHP.**

4. Digital coverage maps for all populations of *Erigeron rhizomatus* on the Navajo Nation. **Distributed directly to the NNHP.**

5. NNHP Element Occurrence Records (EORs) for all populations of *Erigeron rhizomatus* on the Navajo Nation. **Distributed directly to the NNHP.**

6. Additional recommended survey sites for *Erigeron rhizomatus*. **Distributed directly to the NNHP.**

Erigeron rhizomatus Survey and Status Report

Introduction

Erigeron rhizomatus Cronq. (Rhizome Fleabane) is a rare, edaphically limited, habitat-specific member of the Asteraceae (Sunflower family). It is *Listed Threatened* by the Endangered Species Act and has a G2 Global Rank. This ranking indicates that the rare plant has six to twenty known occurrences, or has limited individuals or spatial extent. Arizona and New Mexico State Ranks for the plant are unknown (*Arizona Rare Plant Field Guide*, n.d.).

E. rhizomatus is distinictive from other *Erigeron* species due to its obligate habitat, its peculiar rhizomatus, clump-forming habit, as well as its nearly glabrous achenes and sparsely pubescent stems and leaves. *E. rhizomatus* grows only on nearly barren slopes in clay soil derived from the (structurally and chemically similar) Baca and Chinle geologic formations (*New Mexico Rare Plant Technical Council*, 1999). The Chinle formation is composed primarily of late-Tertiary fluvial and lacustrine deposits.

Outisde of the Navajo Nation, *E. rhizomatus* is known from three locations in the Zuni Mountains (ca. thirty miles east/southeast of Gallup) and approximately thirty locations in the Sawtooth and Datil mountains (ca. eighty miles southeast of Gallup). It was first discovered on the Navajo Nation in 1999. Before this survey there were only five known populations of *E. rhizomatus* on Navajo lands. The plant is otherwise unknown outside of Arizona and New Mexico.

Methods

A status and abundance survey was conducted for E*rigeron rhizomatus* on the Navajo Nation. The survey was conducted between May 5th and July 10th, 2004. A targeted survey method was employed based on the specific habitat requirements of *E. rhizomatus*. The survey objective was to determine the status and extent of *E. rhizomatus* on the Navajo Nation, including: population sizes, population distributions, element areas, abiotic habitat variables, associated vegetation, and potential threats for all populations of *E. rhizomatus*. The survey boundaries were restricted to an area of

potential habitat: from Interstate-40 near Lupton north to Lukachukai, and from approximately N12 east to the eastern flanks of the Chuska mountains.

Habitat determination - *Erigeron rhizomatus* grows primarily on fine textured clay hillsides derived from the Chinle geologic formation. It is currently known to occur between 7,000 and 8,300 feet. Appropriate habitat was determined using a geographical information system (GIS) to overlay geology maps with topographic maps. The intersecting regions indicated potential habitat for *E. rhizomatus*: areas of 7,000- 8,300 feet in elevation, with soil derived from the Chinle formation, and moderate to steep slopes. Habitat determination was also modified qualitatively in the field to include those areas of interest which were not indicated on the GIS due to mapping scale constraints of the geology layer or other unidentified reasons. Twenty-six areas (including the five known populations) were formally surveyed for *E. rhizomatus,* and numerous marginal areas were spot checked for *E. rhizomatus*.

Population sizes – Population sizes were determined using the best possible qualitative estimate for each area. Factors of density, distribution, and population parameters determined the final size estimate for each population. A systematic count and tally method was used for a representative portion of the population, and then total population size was extrapolated.

Population Parameters - Geographic point data were compiled for every population of *Erigeron rhizomatus.* These coordinates indicated the extremities of population distributions and were used to create the outlines of population distributions. Coordinates were recorded using a handheld Garmin eTrex Legend Global Positioning System (GPS). The Universal Transverse Mercator (UTM zone 12, 1927 NAD datum) coordinate system was used. Elevation coordinates were measured in feet. Element areas were estimated in hectares by interpreting population coverages from 1:24,000 topographic maps.

Survey Parameters - Geographic point data were compiled for every survey location. These coordinates indicated the extremities of survey areas and were used to create

outlines of survey distributions. Coordinates were recorded using a handheld Garmin eTrex Legend GPS. The Universal Transverse Mercator (UTM, zone 12, 1927 NAD datum) coordinate system was used. Elevation coordinates were measured in feet.

Maps - Digital coverage maps were created in ArcGIS 8.3. Digital coverage maps for each population of *Erigeron rhizomatus* and for each survey site were created using the GPS parameter coordinates as outer boundaries. These coverage features were overlaid on topographic maps allowing for future identification of population location, as well as providing a spatial context of plant distribution. Element areas were estimated (in hectares) based on interpretation of the digital coverage and topographic maps at a 1:24,000 scale.

Habitat - A habitat description including, location, substrate, slope, dominant vegetation, associated vegetation, and any other pertinent ecological data, was compiled for each population of *Erigeron rhizomatus*. This information is included concisely in the general report, and specifically for each population on the respective EOR forms. Location is described in geographic coordinates (UTM zone 12, NAD 1927) as well as with specific road directions. Substrate definitions are described in the *Substrate* section. Slope was estimated qualitatively. Mild slopes are defined as those slopes less than 10 degrees, moderate slopes as those slopes between 10 and 20 degrees, and steep slopes as those slopes between 20 and 45 degrees. The first several species in each associated vegetation list represent the dominant vegetation for a survey site, while the latter species in the list represent incidental species.

Associated vegetation - A list of associated vegetation was compiled for each population of *Erigeron rhizomatus*. This information is included concisely in the general report and specifically for each population in the EOR forms and on voucher specimen labels. Unknown associated vegetation was collected and identified.

Potential threats - Potential threats were assessed for each population of *Erigeron rhizomatus*. Threat assessment included: evidence of human disturbance, vicinity to

buildings and roads, potential development, livestock pressures, evidence of grazing, and existence of extractive activities.

Substrate - Substrate is described by its geologic parent material, as well as by texture. Fine textured substrate is defined as silt and clay particles (particles so small they were indiscernible with the naked eye). Medium textured soil is defined as predominantly sand particles (particles visible to the naked eye and ca. less than 2.0 mm in diameter) with some intermixed gravel. Coarse textured soil is defined as gravel (particles larger than 2 mm) with some interspersed rocks. A description of substrate is included in the final report, on each EOR form, and with each voucher collection. Digital photographs of substrate are also included for each population of *Erigeron rhizomatus*.

Elevation - Elevation for each voucher collection and population of *Erigeron rhizomatus* was determined (in feet) using a handheld Garmin eTrex Legend GPS. Elevation data is reported with each EOR form and in the *Results* section.

Images - Digital photographs of individuals, habitat, habit, and substrate are provided for each population of *Erigeron rhizomatus*. One copy of photographs is included in the general report and another copy is included with the EOR forms. A digital copy of all photographs is provided as well.

Timetable -

05.06.04 - 05.08.04 EOR Research. Preliminary Field Survey.
06.14.04 - 06.20.04 Field Survey.
06.28.04 - 07.02.04 Field Survey.
07.07.04 - 07.11.04 Field Survey.
08.01.04 - 09.30. 04 Report Writing.

Results

This section provides a data summary for all *Erigeron rhizomatus* populations and survey locations. Note: refer to the respective EOR forms for a thorough description of each population.

Known Populations

Location	ca. Pop'n size	EO size in hectares	ca. Elevation (in feet)	Substrate type/ texture/parent	Slope	Immediate Threats	Overall Relative Ranking*
Whiskey Creek	300	6	7400	clay/fine to medium/ Chinle	moderate to steep	NA	B
Sanostee	100	5	7700	clay/fine to medium/ Chinle	steep to moderate	NA	B
Red Valley	300	20	7450	clay/fine/ Chinle	steep to moderate	NA	A
Oil Field	2500+	27.5	7600	clay/fine/ Chinle	steep to moderate	oil field activity	A
Mile Marker 45	100	2.5	7300	clay/fine/ Chinle	mild	NA	C

* A= Excellent, B= Above Average, C= Marginal

New Populations

Location	ca. Pop'n size	EO size in hectares	ca. Elevation (in feet)	Substrate type/ texture/parent	Slope	Immediate Threats	Overall Relative Ranking*
Whiskey Creek North	250	17.5	7600	clay/fine to coarse/ Chinle	moderate to steep	NA	B
Wheatfields Lake	300	7	7700	clay/fine/ Chinle	moderate to steep	NA	B
Tsaile C	200	4	7600	clay/fine/ Chinle	steep to moderate	NA	B
Tsaile B	75	1	7700	clay/fine/ Chinle	steep	NA	B
Todilto Park	500	3	7475	clay/fine/ Chinle	steep to moderate	NA	A
Sonslea South	500	13.5	7650	clay/ fine to coarse/ Chinle	moderate to steep	NA	A
Sonsela North	350	13	7650	clay/fine to medium/ Chinle	steep	NA	A
Oil Field B	150	4.5	7600	clay/fine to medium/ Chinle	moderate to steep	oil field activity	B
N13	25	0.1	7700	clay/ fine/ Chinle	steep to moderate	NA	C
Lukachukai	75	2.5	7475	clay/ fine/ Chinle	moderate	NA	B-

* A= Excellent, B= Above Average, C= Marginal

Survey Sites where *Erigeron rhizomatus* did not occur

Location	general UTM location	Elevation (in feet)	Substrate type/ texture/parent	Slope	Potential Reason for no Population
Cove	(661596, 4044421)	7125	clay/fine/Chinle	moderate to steep	too low in elevation
Lukachukai 1	(661941, 4032785)	7650	clay/fine/Chinle	moderate	soil chemistry?
New Road	(679043, 3982081)	7300	clay/medium/ Chinle w/debris	mild to moderate	substrate not right, outcrop too small, not steep enough
Red Lake	(677618, 3977600)	7250	clay/fine/Chinle	mild to moderate	not steep enough, outcrop too small
Red Valley East	(678436, 3983084)	7300	clay/fine/Chinle	mild to moderate	not steep enough, outcrops too small, perhaps substrate not right
Tsaile A	(663460, 4022672)	7625	clay/fine/Chinle	moderate	soil chemistry?
Wheatfields Lake C	(673424, 4006964)	7625	clay/fine to medium/Chinle	moderate	outcrop too small
Wheatfields Lake D	(673889, 4011916)	7600	clay and debris/ fine to coarse	moderate	substrate not right, too much intermixed limestone
Wheatfields Lake South	(672882, 4006857)	7600	clay/fine/Chinle	moderate to steep	soil chemistry?
Window Rock	(677057, 3962680)	7300	clay/fine to medium/Chinle	moderate	too low in elevation, outcrop too small

Survey sites were determined using the same criteria for habitat selection as were the inhabited sites. Many of the survey sites simply displayed marginal habitat (whether due to small outcrop size, improper substrate, mild slopes, nuances of soil chemistry, or elevational range) and were not inhabited by *Erigeron rhizomatus*. Several locations however, seemed to meet all of the habitat requirements but were uninhabited. It is difficult to speculate whether this is a result of soil chemistry, seed dispersal, or merely chance.

The Cove and Lukachukai regions were the most notable areas to lack *E. rhizomatus*. There is one small population at the southern extent of the Lukachukai region, but this is somewhat insignificant considering the massive expanse of proper substrate. Both the towns of Cove and Lukachukai are surrounded by massive geologic alcoves of eroded Chinle outcrops, however these areas are simply just outside the elevational range of *E. rhizomatus*. The highest and most representative areas of the Cove and Lukachukai region were survreyed.

Note: refer to the survey site maps for specific parameters of the surveyed areas.

Note: refer to the survey site photographs for examples of uninhabited survey areas.

Discussion:

Habitat - On the Navajo Nation, *Erigeron rhizomatus* grows on fine to medium textured clay hillsides in soil derived from the Owl Rock and Rock Point (Church Rock) members of the Chinle geologic formation. The Owl Rock and Rock Point are the youngest members of the Chinle formation, and in the Chuska mountains they usually occur adjacent to the Wingate Sandstone or the Todilto Limestone. Populations occur only on or near large, steep, eroded outcrops. Populations do not exist on small, mildly sloping, or intact Chinle outcrops.

E. rhizomatus occurs primarily at 7,600-7,700 feet in elevation, however populations exist from 7,300 to 8,000 feet. No populations exist below 7,300 feet in elevation. *E. rhizomatus* grows on moderate to steep slopes, those between 15 and 45 degrees. Individuals can occasionally grow on mild slopes, flats, or along drainages. However in each of these scenarios the majority of the population is distributed on adjacent moderate or steep slopes. Populations do not become established in marginal areas. Aspect has little effect on the quality of potential habitat. Populations exist on all aspects, however north-facing slopes tend to be favored at low elevations due to their increased moisture levels. Populations may become more robust on north-facing slopes, but aspect does not limit habitat selection.

A complex synergy of interspecific competition, moisture availability, outcrop size and slope, and nuances of soil chemistry, seems to dictate habitat suitability.

Population sizes – Population sizes range from ca. 25 individuals to over 2500 individuals per population. The most common number of individuals per populations is ca. 200.

Population Parameters – Population distributions among different populations vary greatly both in shape and area. In some cases plants are regularly distributed throughout the population, and in some cases plants are quite scattered throughout the population. The smallest element area is ca. 1 hectare and the largest element area is ca. 30 hectares.

The average element area is ca. 5-8 hectares. Populations of *Erigeron rhizomatus* are distributed over an area of ca. 400 square miles (ca. 40 miles north-south and ca. 10 miles east-west) on the Navajo Nation. The Todilto Park population is the most southern and eastern population, the Sonsela Buttes populations are the most western populations, and the Oil Field population is the most northern population of *E. rhizomatus* on Navajo lands.

Maps - Digital coverage maps for each population were distributed directly to the Navajo Natural Heritage Program (NNHP).

Associated vegetation - Populations of *Erigeron rhizomatus* primarily occur in *Pinus edulis, Juniperus osteosperma,* and *Pseudotsuga menziesii* dominated areas. Other dominant vegetation includes: *Pinus ponderosa, Cercocarpus montanus, Purshia stansburiana,* and *Amelanchier utahensis*. Common associated species include: *Gutierrezia sarothrae, Achantherum hymenoides, Chaetopappa ericoides, Eriogonum jamesii* var. *flavescens, Purshia tridentata, Brickellia brachyphylla, Brickellia oblongifolia* var. *linifolia, Eurybia glauca, Yucca angustissima, Hymenopappus filifolius,* and *Poa fendleriana*. Unknown vegetation was collected and determined. These vouchers were distributed directly to the NNHP.

Potential threats - *Erigeron rhizomatus'* high degree of specialization contributes to both an increased liability and increased protection from potential threats. Generalist species live in a wide variety of habitats and typically encounter a wide variety of threats. These species can adapt somewhat easily or simply move to a different habitat to avert potential threats. Specialist species live in very specific habitats and typically encounter a reduced number of potential threats. However specialist species cannot easily adapt to new situations or move away from imminent danger.

E. rhizomatus has avoided perhaps its largest threat, interspecific competition, by inhabiting barren slopes devoid of most other vegetation. Its habitat selection also reduces potential human disturbance. The steep slopes on which *E. rhizomatus* grows are difficult for humans to navigate and impossible to develop with infrastructure. Livestock

also avoid the steep Chinle slopes because of the lack of vegetation and the sheer difficulty in navigation. Even in situations where there is clear evidence of livestock activity above or below *E. rhizomatus* habitat, no evidence of livestock activity exists on the actual habitat. Grazing by livestock is non-existent, and grazing by wild animals is infinitesimal (several plants, out of several thousand plants surveyed, displayed evidence of wild grazing; however each of these plants was in the immediate vicinity of water).

E. rhizomatus' specialization has succeeded thus far, but as with all specialist species, its future is somewhat precarious. There is only a limited amount of potential habitat for the plant to choose from. If this habitat is destroyed by human activity, or by potential climate change, *E. rhizomatus* will have no other refuge. It cannot survive in other, less extreme habitats. The Chinle slopes inhabitated by *E. rhizomatus* are often selected for uranium mining. The most robust population of *E. rhizomatus* in the Chuska mountains lies in the middle of an active oil field. These potential threats should be closely monitored and managed.

On an organismal level, *E. rhizomatus* seems to produce an abundance of seeds (tens of seeds per fruiting head and tens of heads per individual), but it remains unclear how easily these wind-dispersed seeds arrive at new areas of potential habitat. Essentially all of the plants surveyed were mature individuals; very few juvenile individuals were observed. Perhaps due to its rhizomatus habit, *E. rhizomatus* matures very quickly, or perhaps a unique set of environmental variables necessitate plant maturation. *E. rhizomatus*' specialization has lead to its success, but also highlights its liability.

Substrate - On the Navajo Nation, *Erigeron rhizomatus* grows on fine to medium textured clay soil derived from the Owl Rock and Rock Point (Church Rock) members of the Chinle geologic formation. Digital photographs of substrate are included for each population of *E. rhizomatus*.

Other Notable Discoveries - During the course of this survey, four populations of *Lesquerella Navajoensis* O'Kane and one population of *Eriogonum lachnogynum* Torr.

ex. Benth var. *sarahiae* (*Eriogonum sarahiae* N.D. Atwood & A. Clifford) were found. Voucher collections for these populations were distributed directly to the NNHP.

Conclusion:

This survey identified ten new populations of *Erigeron rhizomatus* on the Navajo Nation; there are now fifteen known populations of *E. rhizomatus* on the Navajo Nation. The total population of *E. rhizomatus* on the Navajo Nation is ca. 5,000-6,000 individuals. Cumulatively, the element occurs over ca. 200 hectares. Populations of the plant are distributed over ca. 400 square miles (an approximate rectangle ca. 40 miles north-south by ca. 10 miles east-west).

On the Navajo Nation *E. rhizomatus* grows on fine to medium textured clay hillsides in soil derived from the Owl Rock and Rock Point (Church Rock) members of the Chinle geologic formation. Populations occur only on or near large, steep, eroded outcrops. Populations do not exist on small, mildly sloping, or intact Chinle outcrops. *E. rhizomatus* occurs primarily at 7,600-7,700 feet in elevation. The plant grows on moderate to steep slopes between 15 and 45 degrees. *E. rhizomatus* occupies much of its potential habitat throughout the Navajo Nation, but certainly not all of it. A complex synergy of interspecific competition, moisture availability, outcrop size and slope, and nuances of soil chemistry seems to dictate habitat suitability.

Populations of *E. rhizomatus* primarily occur in *Pinus edulis*, *Juniperus osteosperma*, *Pseudotsuga menziesii*, *Pinus ponderosa*, *Cercocarpus montanus*, *Purshia stansburiana*, and *Amelanchier utahensis* dominated areas. Common associated species include: *Gutierrezia sarothrae, Achantherum hymenoides, Chaetopappa ericoides*, *Eriogonum jamesii* var. *flavescens, Purshia tridentata*, and *Brickellia brachyphylla.*

E. rhizomatus' high degree of specialization contributes to both an increased liability and increased protection from potential threats. *E. rhizomatus* has avoided perhaps its largest threat, interspecific competition, by inhabiting barren slopes devoid of most other vegetation. Its habitat selection also reduces potential human disturbance. The steep slopes on which *E. rhizomatus* grows are difficult for humans and livestock to navigate and are impossible to develop with infrastructure. Grazing by livestock does not occur.

E. rhizomatus' specialization has succeeded thus far, but as with all specialist species, its future is somewhat precarious. Specialist species exist in an unsure balance. There is a limited amount of potential habitat for the plant to choose from. If this habitat is destroyed by human activity, or by potential climate change, *E. rhizomatus* will have no other refuge. Extractive practices such as oil drilling and mining on potential habitat should be closely monitored. *E. rhizomatus*' specialization has lead to its success, but also highlights its liability.

This survey identified ten new populations of *Erigeron rhizomatus* on the Navajo Nation. These new populations account for ca. 3000 individuals. *E. rhizomatus* occupies much, but not all, of its potential habitat on the Navajo Nation. The plant's choice of habitat provides some measure of protection from potential threats, but also an obligation to remain in one place. While the species seems healthy within its range, it still only inhabits a very limited area of very unusual habitat. *Erigeron rhizomatus* is a highly specialized species and its future lies in precarious balance. The peculiar plant can only survive in the very places it now lives.

Recommended Survey Sites:

Ten areas of potential *Erigeron rhizomatus* habitat were determined using advanced GIS habitat modeling. It is recommended that theses locations be surveyed in upcoming field seasons. Maps of potential habitat locations were distributed directly to the Navajo Natural Heritage Program.

References:

Arizona Rare Plant Field Guide. A Collaboration of Agencies and Organizations. Arizona Rare Plant Committee. n.d. Unpublished pamphlet.

Endangered, Threatened, and Sensitive Plant Field Guide. Bureau of Land Management Farmington District. Ecosphere Environmental Services, Inc. n.d. Unpublished pamphlet.

New Mexico Rare Plant Technical Council. 1999. New Mexico Rare Plants. Albuquerque, NM: New Mexico Rare Plants Home Page. http://nmrareplants.unm.edu (Version 15, March 2002).