ARIZONA GAME AND FISH DEPARTMENT
HERITAGE DATA MANAGEMENT SYSTEM

Plant Abstract **Element Code:** PDAST3M3N0
Data Sensitivity: Yes

CLASSIFICATION, NOMENCLATURE, DESCRIPTION, RANGE

NAME: *Erigeron rhizomatus*
COMMON NAME: Rhizome Fleabane, Zuni Fleabane
SYNONYMS:
FAMILY: Asteraceae

AUTHOR, PLACE OF PUBLICATION: Arthur John Cronquist, Brittonia 6(2): 274-275. 1947.

TYPE LOCALITY: McKinley County, New Mexico, United States of America.

TYPE SPECIMEN: HT: NY-168534. H.D.D. Ripley 5272 and R.C. Barneby, 16 May 1943. IT: Herb. Barneby.

TAXONOMIC UNIQUENESS: There are 183 recognized species of *Erigeron* in North America, and another 103 subspecies. *E. rhizomatus* is one of 41 species that occur in Arizona; 11 of these are endemic only to the State (NatureServe 2018)/

DESCRIPTION: Herbaceous perennial arising from ascending or upright subterranean stems, with creeping rhizomes. Stems erect, numerous (in clumps), strigose, sparsely branching from near the base, about 3 dm (12 in) in diameter and 2.5-4.5 dm (10-18 in) tall. Flowering stems sparsely leafy, while sterile stems are densely leafy. Leaves alternate, typically less than 1 cm long, oblong and glabrous except for occasional ciliate hairs on the margins and midvein. Flower heads are solitary terminating the branches (blooming at tops of stems), 13-16 mm wide, with involucral bracts in several series. Ray flowers 25-45; white or tinged with pale blue-violet; 6-7 mm long and 1.3-1.5 mm wide; disk flowers are yellow. Achenes 5-6 nerved, nearly glabrous, pappus 25-35 fragile bristles with a few short outer setae. (Falk et al., 2001; nmrareplants.unm.edu).

AIDS TO IDENTIFICATION: *E. rhizomatus* can be differentiated 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 Baca and Chinle geologic formations (Christie 2004).

ILLUSTRATIONS:
Line drawing (Falk et al., 2001)
Color photos of plant and habitat (Falk et al., 2001)
Color photos (W.L. Wagner, USDA NRCS, *in* http://plants.usda.gov)

Color photo of Holotype (Ripley and Barneby, NY-168534, *in* http://207.156.243.8/emu/vh/specimen.php?irn=377228)

TOTAL RANGE: Western New Mexico in the Zuni Mountains (southwestern McKinley County) and the Sawtooth/Datil Mountains (northeastern Catron County) and northeastern Arizona. Previously thought to be endemic to western New Mexico, but found in northeastern Arizona in 1999 and now considered a regional endemic.

RANGE WITHIN ARIZONA: Westside of the Chuska Mountains in Apache County, northeastern Arizona. Disjunct from main range in New Mexico.

SPECIES BIOLOGY AND POPULATION TRENDS

GROWTH FORM: Perennial herb.

PHENOLOGY: Flowers May and June, with fruit noticeable between mid-June and August.

BIOLOGY: *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 (in Arizona) were mature individuals; very few juvenile individuals were observed. Perhaps due to its rhizomatous habit, *E. rhizomatus* matures very quickly, or perhaps a unique set of environmental variables necessitate plant maturation (Christie 2004). In the Datil/Sawtooth Mountains of New Mexico, it was assumed that many of the very small populations that served to genetically link the large populations, were established by seed dispersion. The plant is visited by a variety of pollinators and would be considered as a generalist (Roth and Sivinski 2014).

HABITAT: In Arizona, *E. rhizomatus* is associated with the Church Rock and Owl Rock members of the Chinle Formation (Falk et al 2001). The Chinle formation is composed primarily of late Tertiary fluvial and lacustrine deposits. The species inhabits exposed slopes of detrital clay hillsides, steep easily eroded sandstone slopes and clay banks, with little other vegetation, but within Pinyon-juniper woodlands (NatureServe 2018, Christie 2004, New Mexico Rare Plant Technical Council 1999). A complex synergy of interspecific competition, moisture availability, outcrop size and slope, and nuances of soil chemistry, seems to dictate habitat suitability (Christie 2004).

The New Mexico Zuni Mountain populations are found on substrates derived from Chinle Shale. Plants occur on gray and brown strata that consist of sandy shale or shale that decomposes into very small indurate pieces, which impart a sandy texture to the surface soil. The plants occur on gentle and steep slopes with all exposures (Roth and Sivinski 2014).

The Datil/Sawtooth Mountains populations in New Mexico occur on outcrops of the sedimentary Baca Formation, on steep slopes and all exposures, but primarily north-facing slopes. Substrates are weathered soft sandstones or shales, usually pink or almost white, producing sandy soils on both cliff benches and detrital slopes. The odor of selenium is sometimes detectable on these outcrops, especially when moist. *Astragalus albulus*, a secondary indicator of selenium-laden soils, occurs on almost all of the Zuni Fleabane sites in the Datil/Sawtooth Mountains (Roth and Sivinski 2014).

ELEVATION: In Arizona, the species occurs primarily between 7600 – 7700 feet (2318 - 2349 m), and not below 7300 feet (2225 m.) according to Christie (2004). In New Mexico, the Zuni Mountain populations are found between 7,300 - 7,380 feet (2225 - 2,250 m) and the Datil/Sawtooth Mountains populations range from 7300 – 8300 feet (2225 – 2530 m) per Roth and Sivinski (2014).

EXPOSURE: Zuni Fleabane is found most often on north or east-facing slopes that are moderate to steep (15 – 45 degrees). 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. (Christie 2004)

SUBSTRATE: *E. rhizomatus* is found in close association with the Chinle Formation (in northeastern Arizona and northwestern New Mexico) and the Baca Formation in west-central New Mexico. Both of these formations are structurally and chemically similar (NatureServe 2018; Christie 2004). These formations are often associated with uranium deposits as well as high selenium content. In Arizona, the species occurs on fine to medium textured clay soils derived from the Owl Rock and Rock Point (Church Rock) members of the Chinle Formation (Falk et al 2001). The Chinle Formation is composed primarily of late-Tertiary fluvial and lacustrine deposits. The Arizona populations occur only on or near large, steep, eroded outcrops. Populations do not exist on small, mildly sloping, or intact Chinle outcrops (Christie 2004).

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PLANT COMMUNITY: Pinyon-juniper woodlands. Dominant vegetation includes: *Pinus edulis, Juniperus osteosperma, Pseudotsuga menziesii, Pinus ponderosa, Cercocarpus montanus, Purshia stansburiana,* and *Amelanchier utahensis.* Other common plants are: *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* (Christie 2004).

The most common plant associates in the New Mexico Datil/Sawtooth habitats are *Pinus edulis, Cerocarpus montanus, Juniperus monosperma, Ericameria nauseosa, Yucca baileyi, Gutierrezia sarothrae, Achnatherum hymenoides, Hesperostipa comata, Eriogonum jamesii, Hymenopappus filifolius, Xanthisma grindeloides, Tetraneuris argentea,* and *Oxytropis lambertii*. Other associates occurring in more mesic conditions (shaded habitats at the heads of small canyons and bases of cliffs) include *Pseudotsuga menziesii, Forestiera pubescens* and *Solidago* sp. (Roth & Sivinski 2014). *Astragalus albulus*, a secondary indicator of selenium-laden soils, occurs on almost all of the Zuni Fleabane sites in the Datil/Sawtooth Mountains.

In the two Zuni Mountains sites in New Mexico, dominant associated vegetation consists of *Pinus edulis, Juniperus monosperma, Cercocarpus montanus, Quercus gambelii, Fraxinus cuspidata, Ericameria nauseosa, Yucca baileyi, Gutierrezia sarothrae, Achnatherum hymenoides* and *Pleuraphis jamesii*. No plants that are primary indicator species of selenium-laden soils are present.

POPULATION HISTORY AND TRENDS: Until 1999, when the species was discovered in Arizona, it was thought to be a New Mexico endemic. There are two meta-populations in New Mexico. The type locality is in the Zuni Mountains, along with a second population. The majority of the populations are found in the Datil/Sawtooth Mountains in west-central New Mexico.

In 2004, Christie conducted a systematic survey for *E. rhizomatus* populations on Navajo Nation lands west of the Chuska Mountains in Arizona. He found ten new populations in addition to the five that were already known. For each population, data was collected to estimate total population number, area occupied by the population, elevation, substrate type/texture and parent material, slope, immediate threats and a relative ranking. Estimated population sizes ranged from 25 individuals to over 2500 plants. The total estimated population for all occurrences was 5,725. Areal extent of the populations ranged from 0.1 to 27.5 hectares. The author stated that the most common population size was about 200 individuals, and the average area occupied was 5-8 hectares. Total area occupied 130 + hectares. Elevations ranged from 7300 to 7700 feet. Substrates were all clays derived from Chinle formation parent material. Nine of the 15 populations were found on fine clays, and the remaining on fine to medium or fine to coarse textured clays. All but one of the slope classes are moderate to steep. Four of the populations were ranked as excellent, eight were considered above average, and two were deemed to be marginal. There were another ten sites judged to be potential habitat that were surveyed but no *E. rhizomatous* was found (Christie 2004). The populations are distributed over an area of about 400 square miles (40 miles north-south; 10 miles east-west).

In New Mexico, thirty-eight sites found in the two meta-populations were evaluated in 2014. 3395 individual plants were documented from 34 of the 38 sites, which included five sites documented for the first time. Two sites no longer contained any plants, and two other sites were either miss-mapped or misidentified (Roth and Sivinski 2014). More specific findings, for each of the meta-populations, are summarized below.

On the north slope of the Zuni Mountains near Fort Wingate are two known sites (including the type locality) that comprise the Zuni meta-population. During the 2014 survey these sites had 231 and 75 (306 total) individual plants that were judged to be in fair condition.

In the Datil/Sawtooth Mountains meta-population, 33 large and small sites were evaluated; 28 were previously known and five were newly discovered. One additional site from the BLM Sawtooth ACEC) was also surveyed. The authors estimated that at least 1/3 of the Zuni Fleabane habitat in the Datil/Sawtooth Mountains has not yet been surveyed.

The 33 sites in the Datil/Sawtooth Mountains occupy an area roughly 12 miles (east-west) by 2-4 miles (north-south), or about 36 square miles. These sites are usually less than two miles apart, and it is assumed that this distribution supports the exchange of pollen and some gene flow through the meta-population. It also assumed that the smaller population sites are established from seed dispersal. As such, even the small isolated patches of Zuni Fleabane are important as seed sources for colonizing adjacent habitats and as stepping stones for pollen transfer and gene flow through the meta-population.

A total of 2,920 Zuni fleabane plants were counted at 33 sites in the Datil/Sawtooth Mountains on the Cibola National Forest in 2014. The majority of occupied sites had fewer than 100 plants. Only 6 of the 33 sites had more than 100 plants (site #s 792, 345, 116, 223, 168, 224, see report). The western-most patch of Zuni fleabane in the Sawtooth Mountains is on BLM land. This site contained 169 plants in mostly good condition in 2014 on 0.8 acres. It is notable that for this 2014 survey, none of the population sites in the Datil/Sawtooth mountains were rated in excellent condition.

Population numbers from the 1991 (estimates) and 2014 (actual counts of individual plants) should not be directly compared. Nonetheless, the majority of sites visited in 2014 showed a significant decline in the numbers of plants extant at both of the New Mexico meta-populations, This decline is also corroborated by Sivinski, who has participated in all surveys and has the distinct impression that there were fewer plants and less habitat occupied at most of the 19 sites visited in both years. Further evidence for this downward trend can be derived from several other sites. Two sites (i.e., 14 and 19) were small in 1991 with 30 and 10 plants counted respectively, and were documented as still extant in 2004, but were no longer occupied in 2014. The BLM Sawtooth ACEC 1991 survey documented 876 plants. In 2014, only 169 plants were counted. The two Zuni Mountains sites also illustrated this same decline: in 1994 the type locality estimate was 1000 plants while 300 were estimated at the second site, but in 2014 the actual count was 231 and 75, respectively.

The available information pertaining to the Population History and Trend for *Erigeron rhizomatus* can be summarized as follows. As of 2004, there were 15 known populations in Arizona that occupied an estimated 130 hectares. These populations were scattered over an area of about 400 square miles. The total population estimate (derived by actually counting individual plants in a representative area and then extrapolating to the remaining area occupied at each site) was 5,725 plants. In 2004, the majority of these populations were rated as excellent or above average. In New Mexico, the Zuni Mountain population (two sites) had a total count of 306 plants in 2014. There were 31 population sites in the Datil Mountains and a total plant count of 2,920. These populations were distributed over a total area of about 36 square miles (occupancy areas for each site were not provided). An additional site on BLM land in the adjacent Sawtooth Mountains had another 169 plants. So the total plants tallied from all 34 of the populations in New Mexico were 3,395. In 2014, none of the populations were judged to be in excellent condition, but this was 10 years after the Arizona populations were evaluated and included a drought from 2010 – 2014. Only six of the Datil Mountain sites, plus one from the Zuni Mountains and the BLM site in the Sawtooth Mountains (total of eight sites) had more than 100 plants. The average population count for the 15 Arizona sites (in 2004) was 200 plants. Overall, the Arizona sites had more individual plants per site, but fewer sites distributed over a larger area (400 square miles). New Mexico has more sites, that are more closely situated (promoting genetic exchange), but smaller individual plant numbers per site (generally), and a smaller overall population (approximately 37% of the total estimated population). Also note that the New Mexico study authors felt that about 1/3 of the Datil/Sawtooth Mountains Zuni Fleabane habitat has yet to be surveyed. Population trends in Arizona cannot be determined since there was only a single systematic survey done in 2004. Population trends for the New Mexico populations cannot be directed determined because surveys done in 1991 and 1994 only estimated numbers, whereas the 2014 survey conducted actual counts. Even the authors caution about direct comparisons. Nonetheless, looking at the numbers recorded for the Datil, Sawtooth and Zuni Mountain populations, the populations have declined 82, 81 and 77%, respectively. Again, while the authors state that these general numbers should not be taken as absolutes, there is no doubt that all New Mexico populations have declined very significantly. It is postulated that these declines might be the result of a drought that occurred from 2010 – 2014, that was simultaneously accompanied by higher temperatures.

SPECIES PROTECTION AND CONSERVATION

ENDANGERED SPECIES ACT STATUS: LT (USDI, FWS 1985)
[PT, USDI, FWS 1984]
STATE STATUS: None
OTHER STATUS: Group 2 (NNDFW, NESL 2000 - 2010)

MANAGEMENT FACTORS:

The 1988 Recovery Plan and the 2007 5-Year Review both identified uranium exploration and mine development as the greatest potential threat to *Erigeron rhizomatus*. Recommended recovery actions were to administratively remove the ability to claim minerals beneath Zuni Fleabane populations on federal lands (USDI, FWS 1988, USDI, FWS 2007). Other threats include habitat disturbance by other human activities, road construction/maintenance and possibly related erosion, cattle grazing (trampling rather than consumption), and other extractive activities (NatureServe 2018, Christie 2004).

In Arizona, Christie (2004) found that 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). He also noted that the Chinle slopes inhabited by *E. rhizomatus* are often selected for uranium mining, and the most robust population (Oil Field, 2,500+ plants of 5,725 total) of *E. rhizomatus* in the Chuska mountains lies in the middle of an active oil field.

Christie (2004) also hypothesized that the high degree of specialization of this species contributes to increased protection from some threats, but can also be a liability. By inhabiting barren slopes devoid of most other vegetation, this specialist species has avoided the threats of interspecific competition, many forms of human disturbance, and access by livestock. But the distinctive preference for habitats defined by a narrow elevation band, the more mesic aspects, steep to moderate slopes and specific substrates also means that the specialist *E. rhizomatus* cannot easily adapt to new situations. Given that there is only a limited amount of its preferred or potential habitat, if this habitat is destroyed by human activity (e.g., mining) or future climate change, it will have no other refuge. *E. rhizomatus* can only survive in the very places it now lives, and perhaps some other potential habitat. For this reason, its future is somewhat precarious.

The 5-Year Review (USDI, FWS 2007) evaluated the current progress for each of the three recovery criteria: 1) complete a survey of all potential Zuni Fleabane habitat; 2) develop and implement a habitat management plan and install some permanent monitoring plots; and 3) demonstrate long-term stability (or increases) in population levels and assure that habitat is not threatened by mining activities.

The complete survey of potential habitat criterion has been partially met by extensive surveys on public domain lands including the Zuni and Datil/Sawtooth Mountains, and the Navajo Nation. Potential habitat on some private lands such as the Zuni and Acoma reservations has not been surveyed.

The criterion to develop and implement management plans has been partially met by the 1989 BLM Resource Management Plan and subsequent establish of the Sawtooth ACEC, and the 2005 Cibola National Forest Plan review. It is presumed that adverse impacts on the Zuni Fleabane population within an active oil field in the Chuskas can be managed through the Navajo Nation permitting process for mineral development. There is some discussion on whether permanent monitoring plots is the most cost effective manner of documenting Zuni Fleabane population trends, especially given its ability to spread by asexual clones.

Removing the threat of uranium mining impacts on Zuni Fleabane is the most important criterion for the recovery of this species. A single population in the Sawtooth Mountains has been protected under the ACEC designation by the BLM which withdraws the mineral rights, but this protection will last only as long as this land use planning designation remains in place. Similar efforts to withdraw mineral claims have not yet been made by the Forest Service.

The Five-Factor Analysis in the 5-Year Review (USDI, FWS 2007) addressed the potential negative impacts that threaten the known habitats of *E. rhizomatus*. The primary threat has always been the impact of uranium exploration or mining. Many of the known habitats occur in areas where there are indications of uranium deposits. Although the existing claims are mostly voided by the terms of the 1872 Mining Act, the likely presence of uranium deposits becomes a threat if prices increase and revive the industry in the Zuni and or Datil-Sawtooth Mountains of New Mexico. The single population in the Sawtooth Mountains has been protected under the BLM ACEC designation and will continue to be as long as the ACEC status is maintained in future Resource Management Plans. The northern-most Chuska Mountain population is the only one in Arizona that has actually been impacted by a mineral prospect. The damage was from an old road cut through the population, but interestingly this damage has been partially recolonized by Zuni Fleabane. The largest population in the Chuskas is found within an active oil field and this is considered a potential threat. Other identified threats seem to have very minimal adverse impacts. The aforementioned road cut in the Chuska Mountains has been partially recolonized. If State Road 400 in the Zuni Mountains is widened, only a few plants within the right-of-way might be lost. There was some grazing/trampling damage to the Zuni Mountain Six-Mile Canyon population (within close proximity to a livestock water tank), and this population was subsequently fenced. Most other Zuni Fleabane populations are found on sites mostly devoid of forage plants and do not attract grazing animals. There are no documented reports of recreational impact to any of the known populations.

With regards to other components of the Five-Factor Analysis, there is little need for concern. There is no past or current demand for Zuni fleabane plants for any commercial, recreational or educational purposes. This species has been collected, under appropriate permits, only three times since it was listed as threatened for the purpose of vouchering newly discovered populations in the Chuska Mountains on the Navajo Nation. No disease or predation on the Zuni fleabane is presently known. Existing regulatory mechanisms appear to be functioning. All

Federal and tribal landowners are aware of this threatened species and its locations within their jurisdictions. On Federal lands, land uses must be reviewed and assessed under the EPA section 7 consultation process. The BLM has established the ACEC on lands with Zuni Fleabane in the Sawtooth Mountains, but the current withdrawal of mineral rights will expire in 2026. A review of the Cibola National Forest Management Plan concluded that activities are unlikely to adversely affect this species. Nonetheless, existing regulatory mechanisms are presently inadequate to remove the long-term threat of uranium mining from Zuni fleabane habitats. The 1988 Recovery Plan noted that the proliferation of power plants in the region and their production of acid rain (or acidic dry deposition) might be a future manmade threat to the Zuni Fleabane. However, no damage to Zuni fleabane or other associated vascular plants as been observed.

The most significant finding of the 5-Year Review (USDI, FWS 2007) is that no progress has been made in permanently withdrawing any of these habitats from mineral claim and production since the Recovery Plan prescribed this action in 1988. If future mining operations were to seriously impact or extirpate one or both of these meta-populations, it would indicate a real and potentially pervasive threat that could cause Zuni fleabane to become an endangered species.

The 5-Year Review (USDI, FWS 2007) concluded with recommendation for future actions. The highest priority to facilitate the recovery of Zuni Fleabane was to revise the recovery plan to include the newest information. Administrative actions by Federal land management agencies to reduce the threats from mining activities will be necessary to fully recover the species, and these should be addressed in the revised plan. Although the potential to recover this species is considered to be high, if uranium prices increase and exploration and mining starts again, the opportunity for recovery could be lost. The revised recovery plan should also address the long-term need for special management after Zuni fleabane is removed from the list of threatened species.

During the 2014 survey in New Mexico (Roth and Sivinski), the current status of threats was evaluated. There were some more recent indicators of uranium explorations (e.g., claim stakes) in the Datils. Although there was an exploration project in 2009, the Forest Service did not permit any drilling within any habitat occupied by the Zuni Fleabane. Nonetheless, uranium related activities still pose a threat to this species in New Mexico. Few indicators of land use changes were encountered in the Datils either. No recent woodcutter camps were found and there were only a few cattle trails through the habitats. Elk were the more common large herbivore, but neither elk nor cattle appeared to be grazing the plant. No invasive plant species were encountered. At the Zuni Mountain meta-population sites, it was observed that some individual plants were growing near State Route 400. Although no activities were noted, future highway maintenance or herbicide spraying could damage or eliminate up to 20% of the type locality plants. Invasive exotics (including significant numbers of bindweed (*Convolvulus arvensis*) and sweet clover (*Melilotus officinalis*) were also observed at this site. No exotics

were seen at the second site, and the fence around this site was still functional to exclude livestock and ORVs.

The results of the Roth and Sivinski 2014 survey suggest that there is a new threat to the Zuni Fleabane. There was a significant decline in absolute numbers of plants from previous surveys. Furthermore, although most sites were judged to be in good condition, none were considered to be excellent, and one-third were judged less than good or extirpated. The spring of 2014 was the start of the fourth year of moderate to extreme drought conditions, and 2010 had no measureable rainfall during the monsoon months. Roth and Sivinski (2014) believe that this recent climatic stress is the most likely reason for the decline in population numbers. Neither drought nor climate change have been previous listed as a threat to the species. Moreover, it appears that Zuni Fleabane has survived previous and longer droughts in past millennia. But more recent droughts, and those to come, will be coincident with higher temperatures, and this combination may well be more lethal. If this proves to be true, then a climate changing towards drier conditions, higher temperatures and more persistent droughts could become the most serious threat to *E. rhizomatus* rangewide.

In 2019, a new draft amendment was proposed for the Recovery Plan (USDI, FWS, 2019). This proposed amendment reiterates that surface mining (uranium) is the major threat to Zuni Fleabane habitat and could result in permanent habitat loss and extirpation of local populations. It summarizes that on Forest Service Lands in the Zuni and Datil Mountains, efforts are underway to remove this surface mining threat via mineral withdrawal. The Sawtooth Mountain population is currently protected by a BLM ACEC. And the Chuska Mountain populations have protections because Navajo Natural Heritage Program can restrict development activities in biologically sensitive areas, and because the Dine Natural Resources Protection Act of 2005 has eliminated uranium mining activities on Navajo Nation lands. The draft amendment does not address the climate change threat proposed by Roth and Sivinski in 2014.

The 2019 draft Amendment provides new recovery criteria that will supersede those in the original 1988 Recovery Plan. These new criteria are:

- Over a 20-year survey period, monitoring demonstrates a stable or increasing population in the Datil, Chuska and Zuni populations. During 80 percent of the survey period, an estimated minimum population of 5,000 plants will remain extant in the Datil and Chuska populations, and 700 in the Zuni population. Monitoring will also demonstrate a minimum patch occupancy rate (number of subpopulations with occupied habitat divided by total number of subpopulations) of 60 percent for the Datil and Chuska populations, and 75 percent for the Zuni population.
- The permanent withdrawal from mineral entry for Zuni Fleabane occupied habitat on Forest Service lands or the development and implementation of a habitat management plan (HMP) will be completed. The HMP should include a minimum of a 100 meter (300 foot) surface disturbance buffer around occupied Zuni

Fleabane habitat, and would prioritize avoidance of occupied habitat and ensure connectivity for pollination between subpopulations.

- A Service approved post-delisting monitoring plan will be implemented.

The draft Amendment to the Recovery Plan includes a detailed justification for each of these criteria as well as the rationale that addresses the conservation principles of the 3-Rs: representation, resiliency and redundancy.

PROTECTIVE MEASURES TAKEN:

Erigeron rhizomatus has been Listed Threatened since 1985. The Navajo Nation has considered the species as Endangered (G2: a species whose prospects of survival are in jeopardy) since 2000.

In 2005, the Navajo Nation Council pass the Dine Natural Resources Protection Act which states that no person shall engage in uranium mining and uranium processing on any sites within Navajo Nation Country. This act does not preclude other mineral extraction activities and as noted the largest population of *E. rhizomatus* in the Chuskas is within an active oil field. Roth and Sivinski (2014) state that ESA listed plants only receive limited protections on tribal lands, and this also holds under tribal laws. They conclude that "primary management responsibility for ensuring the continued existence of the species rests with the Cibola National Forest."

In New Mexico, the two Zuni Mountain populations have been withdrawn from mineral claims. Furthermore, the Zuni Mountain Six-mile Canyon population has been fenced to preclude both grazing and ORV access. In the Datil Mountains, however, there are four sites that have been proposed to the Forest Service for the withdrawal of mineral rights, but this matter is still pending, and has been since before the 5-Year Review published in 2007. Even though the Forest Service remains active regarding this plant and did not permit drilling within any of the populations during a 2009 exploration (Roth and Sivinski 2014), the fact that mineral rights are still technically accessible is a concern. Given the policies of the current Federal Government, or an increase in uranium prices, this long-known risk to *E. rhizomatus* populations could move substantially closer to becoming a reality.

The Bureau of Land Management established a 120-acre Area of Critical Environmental Concern (ACEC) on the single population within its jurisdiction in the Datil/Sawtooth Mountains meta-population. This ACEC designation restricts off-road vehicle traffic, excludes rights-of-way, withdraws minerals from claim, and stipulates "no surface occupancy" for fluid mineral leases for as long as this special management area designation is upheld by the Bureau. The current withdrawal from claim of locatable minerals in this Area of Critical Environmental Concern is scheduled to expire on October 9, 2026 (USDI, FWS 2007).

SUGGESTED PROJECTS:

The 15 known populations in Arizona were last surveyed in 2004. Since then, the populations in New Mexico have demonstrated a very significant decrease in numbers that has been tentatively attributed to a drought from 2010 – 2014. It is unknown whether the Arizona populations have also experienced this decline. If so, this would help to substantiate the hypothesis by Roth and Sivinski (2014) that droughts combined with higher temperatures might constitute a new and major risk to the species. At least some, and preferably all, of the 15 Arizona populations should be re-surveyed as soon as possible, and using the same methodology as Christie (2004).

An additional ten areas of potential *E. rhizomatus* habitat were identified by Christie (2004) using advanced GIS modeling. These too should be surveyed to determine if either the geographic range and/or actual numbers of the species are larger in Arizona than currently known.

Roth and Sivinski recommend in their 2014 study that based on the current understanding of the abundance and distribution of Zuni Fleabane in New Mexico and the apparent decline of the species in the past two decades, all habitat and occupied sites of the species should be protected in perpetuity either through withdrawal of mineral claim or other methods of protection. Although drought might be the most significant current threat to the species range-wide, little can be done for these plants in response to drought through land management practices. Hence it is prudent to protect all extant population sites from the impacts of land use practices. Seven key areas were identified holding the largest number of individuals (see Roth and Sivinski 2014). Additionally, the small habitat sites with fewer plants scattered throughout the Datil/Sawtooth meta-population may be important for maintaining genetic diversity and population resilience, and should also be protected from land use impacts.

A definitive plan which identifies both funding sources and a schedule should be jointly developed by the Navajo Nation and Cibola National Forest to monitor the known populations of *E. rhizomatus* to document either further decline or improvements in their condition and/or numbers. A uniform methodology should be agreed upon. Documenting population trends over time is a critical and identified component of the recovery plan (USDI FWS 2007, Roth and Sivinski 2014, and USDI FWS 2019).

Roth and Sivinski (2014) also recommend, considering the apparent range-wide decline in New Mexico, that seeds be collected and maintained in a Center for Plant Conservation approved storage facility. This would allow for potential future reintroduction projects or ex-situ propagation and conservation of plants.

An apparent new threat to *Erigeron rhizomatus* was identified by Roth and Sivinski (2014) as a result of their survey findings. They attributed the dramatic decline in population numbers to a drought from 2010 – 2014 that simultaneously occurred with higher temperatures than previous droughts. They hypothesized that this new combination of drought and higher temperatures might be more lethal to the species. With climate change models predicting warmer temperatures, and droughts being a periodic occurrence in the southwest, this combination has the potential to be a

new and dominant threat. This hypothesis should be addressed in the next 5- Year Review or Recovery Plan Amendment.

LAND MANAGEMENT/OWNERSHIP: In Arizona, USDI Bureau of Indian Affairs – Navajo Nation. In New Mexico, USDA Forest Service and USDI Bureau of Land Management.

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MAJOR KNOWLEDGEABLE INDIVIDUALS:

ADDITIONAL INFORMATION:

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