ELEMENT STEWARDSHIP ABSTRACT

GLOBAL NAME: ***Eriogonum visheri***

GLOBAL COMMON NAME: Dakota buckwheat, Visher's buckwheat, Visher's eriogonum

GLOBAL RANK: G3

GENERAL DESCRIPTION: This is a spring annual herb with an erect stem that is highly branched and arises from a slender taproot, giving it a skeletal appearance. Several roundish basal leaves are arranged in a rosette. The stem leaves, located at the lower forks, are smaller and more oblong than the basal leaves. The flowers appear from July through September and are extremely small, pale yellow, and arise from the forks of the inflorescence.

TECHNICAL DESCRIPTION: Erect, spreading, annual herb, widely scattered individuals or in dense colonies, arising from a slender taproot, the single stem much branched, 15-35 cm high; leaves basal and cauline, the basal leaf ovate to reniform, 1.0-2.5 cm long, 1.0-2.0 cm wide, glabrous and green on both surfaces except sparsely scattered villous hairs along the margin and midvein, occasionally sparsely villous above when young, the margin entire, plane, the apex mostly obtuse to round, the base mostly obtuse or infrequently truncate, the petiole long, slender, 1.0-3.0 cm long, sometimes longer than the blades, sparsely villous to pilose, the cauline leaves elliptic, 0.5-1.5 cm long, 0.5-1.0 cm wide, similar to the basal leaves only more reduced, the petiole short, the leaves restricted to the lower nodes in the axil of the bracts; flowering stems erect, slender, 3-8 cm long, sparsely villous with white hairs; inflorescences open, 5-35 cm long, dichotomously or trichotomously branched at the lower node, dichotomous above, sparsely villous through, but becoming less so above; bracts scale-like, ternate, triangular, 1.0-2.5 mm long, glabrous within and without except for ciliated margins, occasionally villous without in some, connate at the base; peduncles lacking except in the forks of the lowermost branches, these erect, slender, 0.3-1.0 cm long, sparsely villous; involucres turbinate, sessile, and slender-pedunculate, 1.0-1.5 cm long, glabrous within and without except for a ciliated margin, the 5 acute teeth 0.3-0.6 mm long, the bractlet linear-oblanceolate, 1.0-1.5 mm long, minutely glandular to sparsely hirsutulous with white marginal cells, the pedicel 1.5-2.5 mm long, glabrous; flowers 1-few per involucre, yellowish with a slightly darker yellow to greenish-yellow or reddish-brown midrib, 1.2-1.8 mm long in anthesis, becoming 2.0-2.5 mm long in fruit, sparsely hispid with fine hairs especially along the midrib, glabrous within except for scattered minute glands at the base of the midrib, the tepals essentially simple, oblanceolate to oblong, united about 1/5 the length of the flower; stamens slightly exserted, 1.2-1.7 mm long, the filament glabrous, the anther yellowish, 0.3-0.4 mm long, oval; achene dark brown, shiny, ovoid-acuminate, 2.5-3.0 mm long, the large globose base tapering to a long, stout, 3-angled beak. (Ode, 1987; McGregor, 1986)

DIAGNOSTIC CHARACTERISTICS: *Eriogonum visheri* is distinguished from other buckwheats in the region by its skeletal appearance, its distinct basal rosette of leaves that become reddish-brown later in summer, its erect, spreading inflorescence, and its tiny yellow flowers. (Vanderhorst and others, 1998)

STEWARDSHIP SUMMARY: *Eriogonum visheri* is a regional, edaphic endemic, restricted to dry, open outcrops and outwashes within badlands topography. It may be threatened by cattle grazing and trampling, mining, global climate change, and competition from exotic weeds. (Ode, 1987; Peabody, 1995; Schmoller, 1993) Although several surveys have been conducted over the years, little is known about population trends and the impacts of such things as cattle grazing, exotic weeds, and climate change upon this plant. Further monitoring and study are needed. (Ode, 1987; Peabody, 1995; Schmoller, 1993; Vanderpool, 1993)

GLOBAL RANGE: The only known populations of *Eriogonum visheri* in the world are found in the western Great Plains of North America, in western South Dakota, western North Dakota, and southeastern Montana. One population has been located in Montana (Carter county), 14 populations have been located in 7 counties in North Dakota (Billings, Golden Valley, Grant, McKenzie, Mountrail, Sioux, and Slope counties), and at least 79 populations have been located in 8 counties in South Dakota (Corson, Hardin, Jackson, Pennington, Perkins, Meade, Mellette, and Ziebach counties). (Vanderhorst and others, 1998; Lenz, 1993; Ode, 1987; Schmoller, 1993)

IMPACTS: This species has no known impacts upon other species.

GLOBAL HABITATS: Community: *Eriogonum visheri* is found within the Shortgrass Prairie Province, Wheatgrass-Needlegrass section and the Wheatgrass-Grama-Buffalograss section in the west central Great Plains of North America. (Ode, 1987) The Hardin County, South Dakota site is located in the *Agropyron smithii/Carex filifolia* Steppe Habitat Type. (Hansen and Hoffman, 1985)
Geology: Its entire range is found within the unglaciated Missouri Plateau within the Great Plains physiographic province. Within South Dakota it is found on the Cretaceous and Tertiary Table Lands, but never within the Pierre Hills that overlay the Cretaceous and Tertiary Table Lands. It is consistently associated with at least three geologic

formations: the White River formation, Hell Creek formation, and rarely, the Pierre formation. It shows a distinct preference for these geologic formations, shying away from other formations that are adjacent and at similar topographic position. In South Dakota the plants were found on the Chadron and Brule phases of the White River formation and at one site the plants were found on the Yellow Mound Member and Interior phase of the Pierre formation. All three formations are composed of claystones, siltstones, sandstones, and shales with infrequent porcelainite and lignite beds. Within these formations, *Eriogonum visheri* will be found on barren, sedimentary rock outcrops, the alluvium of such outcrops, and small exposures of soil substrates within badlands topography. The geologic structures include buttes, tables, canyons, arroyos, shallow dry washes, blowouts, terraces, and slumps. Amidst these structures, the plant is most often found on the unvegetated clay outwash at the base of slopes, on the unvegetated eroding edge of tables, benches, terraces, and buttes, and on somewhat level patches of soil exposed by wind or water erosion. (Ode, 1987; Schmoller, 1993; Schmoller, 1995) At some North Dakota sites it has been found within or adjacent to porcelainite within badlands topography. (Lenz, 1993)
Soil: The soils associated with *Eriogonum visheri* are less often considered soils and more often considered rock outcrops with minimal podzolization. Where soil has been formed it is considered to be of the Entisol soil order. In South Dakota, these were Badlands, Interior, Cedar Pass or Cabbart soil types. (Schmoller, 1993; Schmoller, 1995) In Montana, the soils were derived from eroding bentonite and were vesicular silt. (Vanderhorst and others, 1998) Typically, the soil is low in organic matter, has high pH, fine texture, high shrink-swell capacity, low infiltration rates, low soil moisture, and low fertility. Often these soils are strongly calcareous and high in sodium. At the sites where there were soils had better horizonation, lower pH, and higher organic matter the plants displayed a more vigorous, robust appearance. (Vanderhorst and others, 1998; Ode, 1987; Schmoller, 1993; Schmoller, 1995)
Vegetation: While vegetation is commonly sparse at the *Eriogonum visheri* sites, associated species do occur. In North Dakota these include *Agropyron dasystachyum, Agropyron smithii, Artemisia tridentata, Astragalus racemosus, Atriplex argentea, Atriplex nuttallii, Distichlis spicata, Eriogonum pauciflorum, Grindelia squarrosa, Gutierrezia sarothrae, Machaeranthera canescens, Melilotus officinalis, Oenethera cespitosa, Salsola iberica*, and *Sarcobatus vermiculatus*. (Lenz, 1993; Peabody, 1995; Vanderpool, 1993) In South Dakota these include *Agropyron trachycaulum, Astragalus racemosus, Artemisia cana, Atriplex argentea, Atriplex canescens, Chrysothamnus nauseosus, Distichlis spicata, Dyssodia papposa, Eriogonum pauciflorum, Gutierrezia sarothrae, Kochia scoparia, Machaeranthera canescens, Oryzopsis hymenoides, Polygonum ramosissimum, Salsola iberica, Solanum rostratum, Sphaeralcea coccinea*, and *Helianthus annus*. (Ode, 1987; Schmoller, 1993) In Montana these include *Allium textile, Atriplex confertifolia, Atriplex gardneri, Artemisia tridentata spp. wyomigensis, Elymus lanceolatus, Kraschnekovia lanata, Musineon divaricatum, Oenethera cespitosa*, and *Sitanion hystrix*. (Vanderhorst and others, 1998)
Site Conditions: *Eriogonum visheri* inhabits sites at elevations between 1900 and 3000 feet. It occurs amidst relatively harsh growing conditions. Ground cover is lean, with a minimum of 50% bare ground, and more often an excess of 90% bare ground. Light is open, with minimal shading from surrounding geology. Erosion and deposition rates are high. Where the species occupies the badlands outwash, the slopes are low, where the species occupies the edges of alluvium the slopes are steep. (Vanderhorst and others, 1998; Ode, 1987; Schmoller, 1993) The climate is severe, influenced by the Rocky Mountains to the west. In South Dakota the climate is classified as Type BSk, middle latitude, semi-arid steppe. Seasonal precipitation and temperatures vary widely. Lemmon, South Dakota, in the midst of the range of *Eriogonum visheri*, has recorded a record high of 115º F and a record low of -45º F. (Ode, 1987) Others have observed high temperatures of 121ºF at Kadoka, South Dakota, and a low of -46ºF in Philip, South Dakota. (Schmoller, personal observation). Rainfall is spare. In western South Dakota it averages about 15 or 16 inches a year, most of it coming in the form of spring and early summer showers and thunderstorms. Precipitation in the rest of the range of *Eriogonum visheri* is similar. (Ode, 1987)

GLOBAL ECOLOGY: *Eriogonum visheri* is a summer annual, primary successional species. (Ode, 1987)
It inhabits harsh and erosive environments where competition and succession are limited; refuges from more competitive plants. The high erosion and deposition rates at the sites uproot or bury plants. The soils have a high shrink-swell potential that damages plant roots. The high sodium, high pH, and low nutrition of these sites also serves to limit competition and succession. Wind erosion may also be a factor. The strong winds seen in this province may aid in the exposure of soil, creating blowouts, thus limiting competition and succession. While limiting competition and succession, the wind and water erosion present in its environment appears to serve to both disperse seeds and create suitable microhabitats or safe-sites for the species. Small mammals and resident and passerine birds may collect and disperse the seeds. (Vanderhorst and others, 1998; Ode, 1987; Schmoller, 1993)
No mycorrhizal, symbiotic, or parasitic relationships are known for this species.

GLOBAL REPRODUCTION: It appears that dispersal, germination, and seedling establishment of *Eriogonum visheri* are dependent upon several factors. As an annual plant, it is dependent upon the size and condition of its seed bank for germination and seedling establishment. Its seed production and viability are not known. The erosional factors that limit the populations of other species appear to create safe-sites for the germination and seedling establishment of *Eriogonum visheri*. Dispersal of *Eriogonum visheri* seeds may be accomplished by both wind and water erosion since its seeds, lacking wings or plumes, are very small. The seed rain has been observed to remain largely beneath the parent plant. It has been suggested that Least chipmunks, resident and migratory passerine birds such as Baird's

sparrow, Snow buntings, Lapland longspurs, Say's phoebes, and Rock wrens may collect and disperse the seeds. Both seed scarification and stratification may be required prior to germination. The species is proandrous, wind pollinated, and self-fertile. (Ode, 1987)

ECONOMIC USES: There are no known economic uses of this plant.

GLOBAL THREATS: Significant threats to populations of *Eriogonum visheri* are cattle grazing and trampling, mining, competition from exotic weeds, global climate change, and problems inherent in regional endemics.
Cattle grazing and trampling is a current, man induced threat. Increased stocking levels has the potential to threaten the species to a greater degree. The effect of cattle grazing and trampling upon populations of *Eriogonum visheri* is complex. Due to the paucity of vegetation, cattle grazing is not common at these sites. And the plant does not appear to be selected by cattle for grazing; indeed, cattle do not select *Eriogonums* as a whole. (USDA, 1988) *Eriogonum visheri* is associated with plants that, on the whole, are not selected by cattle. (Johnson and Nichols, 1982; USDA, 1988) When grazing does occur, it appears to be inadvertent or when little else is available for forage. It is suggested that some grazing may bring benefits by selecting species that compete with *Eriogonum visheri*, species such as *Salsola iberica*. And it is suspected that some of the grazing observed may actually be the result of small mammals or other wildlife. Trampling is not common at these sites, again, due to the lack of good forage. When trampling is observed, it appears to be from the travel of cattle from one patch of favored forage to another. Trampling has been observed to damage some plants. And trampling may disturb habitat suitability and create sites suitable for species that compete with *Eriogonum visheri*, species such as *Kochia scoparia, Salsola iberica,* and *Melilotus officinalis*. But the presence of the *Eriogonum visheri* within cattle trails suggests that trampling may disperse and implant its seeds. An increase in stocking levels that would result in degradation of the range would likely override any benefits to the species and hasten its decline. (Vanderhorst and others, 1998; Ode, 1987; Schmoller, 1993)
At present, mining is not a threat to the species. But some significant coal deposits occur in the vicinity of several populations in northwestern South Dakota, thus mining has the potential to be a serious human induced threat. Strip mining of these reserves, which is the method of choice in this region, would result in the destruction or disruption of several populations. (Ode, 1987) It must be noted that ground-disturbing activities are not necessarily detrimental to the species. It has been observed that the species has colonized areas disturbed by human activity such as ditching for a pasture road. (Schmoller, 1993; Vanderpool, 1993) However, human activity may expose substrate making it open to invasion by nonnative weedy species that may have a competitive advantage over *Eriogonum visheri*. (Vanderpool, 1993)
Exotic weeds are a current, man induced threat. Exotic weeds have been observed in the same habitats as *Eriogonum visheri*. The two exotic species of particular concern are *Salsola iberica* and *Kochia scoparia*. While these species have been observed growing alongside healthy *Eriogonum visheri* plants, these species produce a tremendous amount of seeds and, in early spring, a dense carpet of seedlings. The competition between *Eriogonum visheri* and these two species for suitable seedbeds, water, and nutrients is likely to be intense. Further, *Eriogonum visheri* appears to be a poor competitor. (Crowley, 1998; Ode, 1987; Vanderpool, 1993) Other species that may pose a similar threat are *Bromus tectorum, Bromus japonicus*, and *Melilotus officinalis*. Degradation of the range, which benefits exotic weeds, would increase the potential threats posed by exotic weeds. (Vanderhorst and others, 1998)
Global climate change is a current and potential, human induced threat. As an annual that has demonstrated strong fluctuations in its population in response to variations in climate, it may be adversely affected by global climate change. (Ode, 1987; Peabody, 1995; Vanderhorst and others, 1998)
One natural, current threat is the set of problems inherent to regionally endemic populations. They face the threat of genetic depression, seed bank decay, and greater vulnerability to rapid habitat changes. (Crowley, 1998)

GLOBAL STATUS: Currently, the species has a global ranking of G3. Up until 1996 it was listed with the US Fish and Wildlife Service as Category 2, but at present, it has no current conservation status with the agency. Prior to its removal from this listing, two status reviews recommended that the species be classified as a 3C species under the Endangered Species Act, indicating no imminent danger of extirpation but warranting further monitoring. (Ode, 1987; Peabody, 1995) It is ranked with the Montana Natural Heritage Program as S1. The North Dakota Natural Heritage Program lists it as a species of management concern. The South Dakota Natural Heritage Program ranks it as S3. The US Forest Service Region 2 lists the plant as a Sensitive Species. (Vanderhorst and others, 1998; SDNHDB, NDNHP)

GLOBAL TRENDS: Detailed trend data is lacking. (NDNHP) Several reasons account for this. First, intensive surveys for the species were not initiated until the late 1980's. Second, most populations have been discovered since 1993. Third, only a few surveys have been commissioned, usually without follow-up surveys. A literature and phone search was unable to account for any more than nine broad surveys for the species in Montana, North Dakota, and South Dakota: Ode in 1987, Buffalo Gap National Grassland in 1991 and 1993, Vanderpool in 1993, Lenz in 1993, Peabody in 1995, Heidel and Dueholm in 1995, and surveys in Badlands National Park and Theodore Roosevelt National Park.

The presence of the species in badlands within the short grass province is to its advantage. Development and other anthropogenic factors are at a minimum in these locations, and the primary use of these sites for grazing does not appear to present any imminent threat of extirpation.

RESTORATION POTENTIAL: Since little exists on the trends or historical populations of this species, it is difficult to speak of restoration. Many seemingly suitable sites do exist for this plant throughout the badlands region. For example, the Brule and Chadron formations that contain many of the South Dakota populations extend from the North Platte River in Wyoming and Nebraska to the White River in South Dakota. Only one population has been found south of the White River, that in Mellette county, by the Little White River. The potential for propagation of the species on these sites does exist. (Schmoller, 1993) Seeds have been sent to the Center for Plant Conservation at the Nebraska Statewide Arboretum in Lincoln, Nebraska. (Ode, 1987; CPC)

PRESERVE DESIGN CONSIDERATIONS: At present, no preserve designs have been proposed. In order to design a preserve, some basic questions need to be answered.
First, what is the goal of the preserve? It is recommended that the goal be at a minimum to preserve the populations, habitat, and ecosystem of *Eriogonum visheri*. The introduction of the species into new sites might be a desired goal.
Second, what information is required? Data on this species is lean. It is recommended that research be directed toward an understanding of the populations, habitat, and ecosystem of the species, especially toward population trends, population history, threshold levels, competitors, seed dispersion methods, specific substrate requirements, affect of climate variations, and threats. This implies the establishment of permanent monitoring sites and the continued analysis of the species' habitat and behavior.
Third, what sort of preserve must be selected? It is recommended that one be selected which accommodates all processes required for the maintenance of a viable population. This means selecting a location that has high erosion and deposition rates within a dense clay substrate. And it is recommended that preserves be established within each of the geological formations that it prefers. And it is recommended that preserves be established with the ability to limit or mitigate threats. Specifically, it is necessary that the preserve contain moderate to low levels of livestock grazing, a minimum or absence of exotics, little or no ground disturbing activities such as road building, mining, or farming.
Fourth, what would constitute acceptable results? This would be an expression of the original goal. Results must be measurable, so the preserve needs to have permanent monitoring plots and a monitoring program. (Ode, 1987; Peabody, 1995; Schmoller, 1993; Vanderpool, 1993)

MANAGEMENT REQUIREMENTS: In many ways, present management does not appear to spell swift and sudden doom for *Eriogonum visheri*. For example, one threat, the proliferation of exotic weeds, has been continuing apace since their explosion during the drought of the 1930's. The continued existence of *Eriogonum visheri* during this period suggests that these exotics do not pose a short-term threat to its existence. Similar remarks might be made for slight or moderate levels of cattle grazing which have continued for decades. Nevertheless, it cannot be stated whether or not the past decades of exotic species, cattle grazing, farming, or global climate change have altered the range of the species. And should current management worsen, adverse effects would be expected. The impacts of overgrazing would be felt, not only in the general degradation of the range, but in the advance of exotics, destruction of safe-sites, and an increase of direct grazing and trampling of the species. Hence, modest stocking levels and sensible grazing rotations should be established or maintained on all federal and state lands and encouraged on private lands. And efforts to eradicate exotic species should continue. Farming is not likely to impact the species directly, due to the unsuitability of the land for raising crops. However, a retreat to the farming practices that played such a major role in the dustbowl of the 1930's would surely spell the decline of this and many other sensitive species. (Ode, 1987) Global warming has implications far beyond the extinction of one regional endemic. The reduction of the output of greenhouse gasses is essential.
In addition to these management practices, efforts might be made to colonize suitable habitats in the region. And monitoring populations of *Eriogonum visheri* is an essential part of a good management plan.

MANAGEMENT PROGRAMS: There are no known management programs in operation. The National Grasslands that administer land containing *Eriogonum visheri* operate under a Forest Plan that mandates the protection of sensitive species habitat and populations.

MONITORING REQUIREMENTS: All comments on monitoring suggest the establishment of permanent monitoring plots. It is suggested that the plots be visited on an annual basis, that they be established at the population and subpopulation level, that they be established on a variety of habitats - in the very least on each sort of geologic substrate on which it is found, and that target surveys are conducted on suitable habitat. (Peabody, 1995; Ode, 1987; Schmoller, 1993; Vanderpool, 1993)

MONITORING PROGRAMS: There are no known monitoring programs in operation.

MANAGEMENT RESEARCH PROGRAMS: There are no known management research programs in operation.

GLOBAL RESEARCH NEEDS: The consensus among surveyors is that the species requires further survey and monitoring. (Ode, 1987; Peabody, 1995; Vanderpool, 1993; Schmoller, 1993) Trend data is lacking and the possibility that additional populations of this species exist cannot be discounted with any ease. For example, the Brule and Chadron formations that contain many of the South Dakota populations extend from the North Platte River in Wyoming and Nebraska to the White River in South Dakota. To date, only one population has been found south of the White River, that in Mellette County by the Little White River. (Ode, 1987; Schmoller, 1993)
Vanderpool, in her survey of 1993, suggested the establishment of permanent monitoring plots on the population and subpopulation level with a view to observing the impact of climate, human activity, secondary succession, and exotic weeds on *Eriogonum visheri* populations and seed banks. (Vanderpool, 1993) Peabody, in his survey of 1995, suggested that permanent monitoring plots be established to evaluate populations on an ongoing basis. He suggested particular attention be focused on the correlation between precipitation patterns and anthropogenic factors and the *Eriogonum visheri* populations. (Peabody, 1995) Schmoller, in his survey of 1993, recommended proactive surveys on apparently suitable habitat. This would be with the objective of locating new populations and to discern the particular habitat requirements of the species. Additionally, these habitat requirements could be elucidated through a comparison of the habitat of known populations across its range. (Schmoller, 1993) Ode, in his survey of 1987, recommended that further searches for *Eriogonum visheri* be conducted, that livestock exclosures be constructed around populations to monitor the long-term effects of grazing on the plant, and that populations should be monitored to determine population patterns and the impact of exotic weeds. (Ode, 1987)

MANAGEMENT RESEARCH NEEDS: The management research needs for the species are hostage to the need to gather baseline data on the species, particularly population numbers, locations, and trends.

ADDITIONAL TOPICS: Little or no information has been found concerning economic or herbal uses, mycorrhizal, allelopathic, symbiotic relationships, pollinators, seed bank viability, or consumers of this species. No information has been found on Native American uses or regard for this species. Individuals with considerable knowledge about this species include:
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INTERNET:

CPC - Center for Plant Conservation -www.mobot.org/CPC

NDNHP - North Dakota Natural Heritage Program -www.heritage.tnc.org/nhp/us/nd

SDNHDB - South Dakota Natural Heritage Data Base -www.heritage.tnc.org/nhp/us/sd

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