eriogonum visheri survey 2005-6

yellowfield biological surveys

ERIOGONUM VISHERI SURVEY 2005-6
GRAND RIVER RANGER DISTRICT
DAKOTA PRAIRIE GRASSLANDS

ABSTRACT

Rare plant surveys were conducted in the late summer and early fall of 2005 and 2006 on 10,710 acres of the Grand River Ranger District of the Dakota Prairie Grasslands in Corson and Ziebach Counties, South Dakota. These surveys described 465 populations of Dakota buckwheat, or *Eriogonum visheri*. These contained an estimated 51,065 plants and occupied an area of 84942m² (20.99 acres). Of the 14 historic populations of *E. visheri,* 13 were accounted for. The 14 historic populations corresponded to 40 populations in this survey. Thus, 425 new populations were found. It is likely that a small number of populations escaped detection due to the convoluted badlands terrain.

Habitat requirements included Hell Creek or Ludlow formation geology, high erosion rates, clayey soil with high shrink-swell capacity, and open vegetation structure such as that found on the outwash at the base of badland buttes, on clayey slickspots, on the popcorn-weathered clay sideslopes of badland buttes.

Most populations were thriving, robust, and in flower, despite extreme heat and drought. No significant adverse impacts from human activity, cattle grazing, or noxious weeds were observed. Moisture stress appeared to be the greatest threat to population viability. Other significant findings included five populations of *Talinum parviflorum*, one population of the noxious weed *Circium arvense,* eight springs, two spring bogs, nine closed depressions, two large nests, one Upland sandpiper (*Bartramia longicauda*), and one garbage dump. No alterations in the current grasslands management program were recommended, but rare plant monitoring and proactive surveys were advised.

PROJECT INFORMATION

Dakota buckwheat (*Eriogonum visheri*) is a rare, summer annual plant. It is a regional, edaphic endemic, restricted to dry, open outcrops and outwashes within badlands topography in western South Dakota, western North Dakota, and eastern Montana. Currently, the species has a global ranking of G3. It is a Federal Species of Management Concern and the Rocky Mountain Region of the U.S. Forest Service lists it as a Forest Service Sensitive Species in North and South Dakota. It is ranked S3 in South Dakota, S2-S3/E in North Dakota, and S1 in Montana.

The species has a presence on the Dakota Prairie Grasslands (DPG) in the western Dakotas. Dozens of historic populations are scattered across the Grand River Ranger District (GRRD) in Corson and Perkin Counties in western South Dakota. Seventy-one historic populations were located within eight allotments on the GRRD. The allotments were Texley, Petik, Miller, Hofer, Shambo, Pasture 8, Pasture 9, and Waldecker. The latter three allotments were surveyed in 2004 (Schmoller, 2004). The five allotments not surveyed in 2004 contained 14 historic *E. visheri* populations. These are presented in **Table 1***, Historic* Eriogonum visheri *populations.*

Table 1. *Historic* Eriogonum visheri *populations*.

ALLOTMENT	# SITES	# PLANTS	DATE	SURVEYOR
Hofer	2	54	9/25/2001	K. Hansen
Miller	4		7/30/1995	
Petik	6		9/25/2001	K. Hansen
Schopp	1			
Shambo	1	70	9/25/2001	K. Hansen
TOTALS	**14**	**124**		

On July 22, 2005, the DPG proposed a rare plant inventory of the *E. visheri* populations on the allotments not surveyed in 2004. Several neighboring allotments were included in the survey.

The list of allotments and acres surveyed in this project is presented in **Table 2**, *Allotments Surveyed*.

The objective of the survey would be to locate and map all *E. visheri* populations within the survey area, collect population data, and obtain an overview of the status and condition of these populations on the GRRD. All historic populations would be revisited. The proposed survey area amounted to approximately 16¾ sections of land or 10,710 acres. David and Amy Schmoller of Yellowfield Biological Surveys were contracted to perform the survey. A pre-work meeting was held with Kurt Hansen on September 24, 2005 at which time the DPG provided project information such as topographic maps, aerial photographs, GPS standards, and the locations of historic *E. visheri* popu-

lations. The GRRD provided an Off Road Travel permit allowing for the use of an All Terrain Vehicle (ATV) or a four wheel drive pickup truck to access the survey area. The inventory and assessment for *E. visheri* was conducted during September 2005 and September-October 2006. DPG Forest Service Botanist Kurt Hansen supervised the project. The final report was composed in February 2007.

Table 2. ***Allotments Surveyed***

NAME	TOWNSHIP-RANGE					ACREAGE
	17-18	18-17	18-18	19-17	19-18	
Anderson		24				160
Buer			3, 8, 11, 17, 20, 21, 22			2120
Dries			31			320
Hofer			20, 23, 25, 26, 27, 28			2320
Lyon		35				320
Miller					14, 24	800
Parrott			5, 6			270
Petik			13, 24		14, 15	920
Pressler			4			80
Schopp			9, 10, 15			840
Shambo	3, 4		32, 33, 34			720
Texley				11, 12	7, 8	1840
TOTAL						**10710**

METHODS

The rare plant surveys were conducted according to the guidelines published in J. R. Nelson's publication, *Rare plant surveys: Techniques for impact assessment* (Nelson 1985). Late summer surveys were arranged in order to coincide with known flowering times of *E. visheri*. All sites were accessed by a four-wheel-drive pickup, an ATV, or on foot. All sites were inspected on foot or, where no adverse impact would occur, by ATV. Surveys were conducted at an intuitive controlled survey intensity level. Two surveyors participated in the field surveys.

All 14 historic populations were revisited so as to confirm, describe, and map the populations. The survey extended beyond the boundaries of the known populations to embrace all suitable habitat within the five allotments.

When *E. visheri* populations were encountered the general ecology was described. This site data was logged into the GPS unit. Date included the following: location, population size, estimated area covered by the population, geomorphology, and substrate. Any unusual or noteworthy features were described. This data was transcribed in **Appendix 1**, *Site Data*.

Plants were identified in the field based on the descriptions in the plant keys listed in the **Bibliography** on page 10. Close-up photographs served to confirm the identity of the species. No voucher specimens were collected. Population densities were determined by visual estimate or actual count. Detail and panoramic photographs were taken using a Kodak© DX6490 digital camera. Selected photographs are included in this report.

Eriogonum visheri population locations were identified using Garmin© 12XL and Trimble Geoexplorer© 3 GPS units. Larger populations were described by polygons and smaller populations were described by points. An explanation of terms used in identifying sites logged in the GPS units is listed in **Table 4**, *Waypoint Definitions*. Using Pathfinder Office 2.8, Trimble GPS data was differentially corrected over the internet using the base station at CORS, Medora 3, ND. Waypoints are listed in **Appendix 2**.

Using Maptech© software, population locations were displayed on topographic maps. These maps are displayed in **Appendix 3**.

Weekly reports were submitted to Kurt Hansen. A report summarizing the survey findings was composed on a desktop PC.

Table 4. ***Waypoint definitions***

GARMIN 12XL DEFINITIONS

Example: "001"
001=*Eriogonum visheri* site number
Non-*E. visheri* sites will have some of the following information:
BOG = Subirrigated meadow
CIRARV = *Circium arvense* population
CLDEP = Closed depression
DINO = Dinosaur bone(s)
GARBAG = Garbage dump
NEST = Raptor nest
SPRIN = Spring
TALPA = *Talinum parviflorum* population
UPSAND = Upland sandpiper, *Bartramia longicauda*

Waypoints collected in 2005 were assigned new numbers in 2006:
Trimble Garmin
001-073 TEXLEY = 361-433
001-004 PARROTT = 434-437
001-018 BUER = 438-455
001-010 SCHOPP = 456-465

TRIMBLE GEOEXPLORER 3 DEFINITIONS

Example: "448 300 5x4 ow "
448 = *Eriogonum visheri* site number
300 = number of plants
5x4 = area covered by plants
Geomorphic site descriptions:
ow or **o** = generally flat outwash usually at badland base
ss or **s** = population on sideslope
gr or **g** = gravelly substrate, usually mixed with dense clay
sd or **sand** = sandy
c = dense clay
r = rivulet, usually in outwash at base of badland
Non-*E. visheri* sites will have some of the following information:
BOG = Subirrigated meadow
CIRARV = *Circium arvense* population
DINO = Dinosaur bone(s)
DUMP = Garbage dump
NEST= Raptor nest
SPRING = Spring
TALINUM = *Talinum parviflorum* population
UPLAND SANDPIPER = *Bartramia longicauda*

RESULTS AND DISCUSSION

1) TABLE SUMMARIZING SIGNIFICANT FINDINGS

Table 5. ***Summary of significant findings***

FEATURE	SITES	POPULATION	AREA	NOTES
Eriogonum visheri	465	51065	84942m²	13 historic populations included
Talinum parviflorum	5	1310	122m²	Only in 2005, too hot and dry in 2006
Circium arvense	1	1000	150m²	On private land
Springs	8			
Subirrigated meadow	2			Subirrigated Juncus meadow
Closed depression	10			Large site in Anderson
Raptor nest	2			One ground nest
Upland sandpiper	1	1		
Garbage dump	1			Historic, abandoned, on FS land

2) TABLE SUMMARIZING E. VISHERI FINDINGS AT HISTORIC SITES

Table 6. ***Summary of* E. visheri *findings at historic sites***

ALLOTMENT	HISTORIC SURVEY		FOUND?	2005-2006 SURVEY		NOTES
	SITE #	# PLANTS		SITE #	# PLANTS	
Hofer	1	15	YES	134, 135, 136, 137, 138	49	south site
	2	39	YES	143	10	north site
Miller	1 north		YES	283, 284	125	near north fenceline
	2 fence		YES	279, 280, 281, 282	1025	along Petik fenceline
	3 dam		NO			site NE of dam, trampled, dusty
	4 SE		YES	273	15	by corner fencepost
Petik	1		YES	76	5	most of old site on private land
	2		YES	67, 68, 69	300	
	3		YES	23, 24, 25, 30, 31	720	
	4		YES	4, 5, 6, 7	3740	
	5		YES	207, 208, 209	750	in section13
	6		YES	219, 220, 221, 222, 223, 224	270	
Schopp	1		YES	456, 457, 458, 459	200	by spring bog
Shambo	1	70	YES	206	100	
TOTALS		**124**			**7309**	

3) GENERAL DESCRIPTION OF PROJECT AREA

The survey area is within the Moreau Prairie physiographic region within the Northwestern Great Plains ecoregion. It is in the Grand River watershed. It is mixed grass prairie or Northern Wheatgrass-Needlegrass Plains characterized by rolling, grassy uplands, badlands, and wooded riparian areas. It has inclusions of the Little Missouri River Badlands. The region has a semiarid continental climate. Temperatures are extreme, winds are relatively high, and annual precipitation is low. Most precipitation arrives as spring rain.

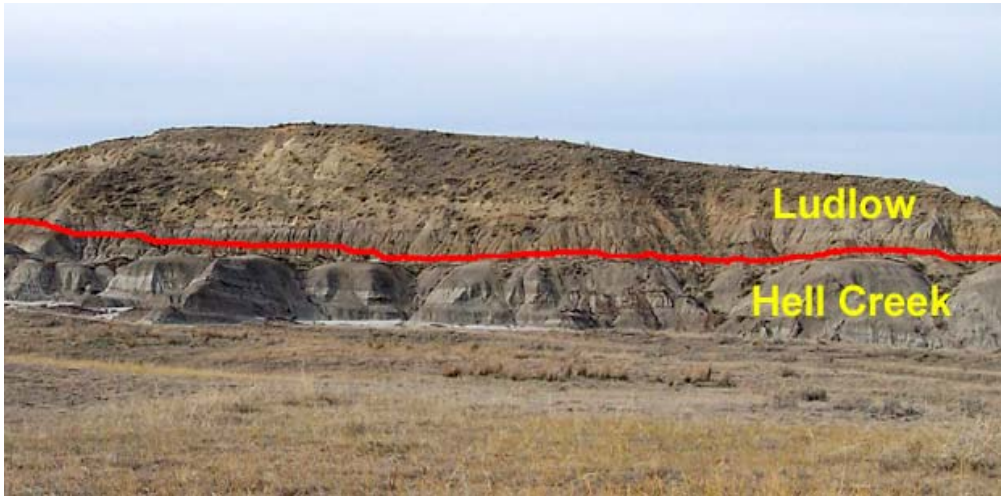

Figure 1. Red line shows contact between Ludlow and Hell Creek formations.

The geologic formations in the survey area are Hell Creek and Ludlow formation ***(Figure 1)***.

The **Hell Creek** formation is a series of grayish, mostly bedded, freshwater claystone, siltstone, mudstones, and sandstones and lesser amounts of lignite. It was deposited during the **Cretaceous** period at the end of the **Mesozoic** Era. It contains sedimentary features such as siderite nodules, mud cracks, raindrop impressions, ripple marks, and bird and animal tracks. It has produced many excellent and renowned dinosaur skeletons, including *Triceratops* and *Tyrannosaurus rex.* Most of the badland topography in the survey area is Hell Creek formation.

The **Ludlow** formation is of more recent origin and lies on top of the Hell Creek formation and dates to the early **Paleogene** (formerly Tertiary) period at the beginning of the **Cenozoic** Era. Much like the Hell Creek formation, it is composed of bedded claystones, siltstones, mudstones, and sandstones interlayered with lignite. It is distinguished from the Hell Creek formation by the persistence of lignite and a brownish hue. This formation is predominant on the rolling, grassy terrain typical of the higher elevations of the survey area.

The riparian areas along Twin Butte Creek and Black Horse Creek contain modern, late **Neogene** (formerly Quaternary) period or **Holocene** epoch alluvium and alluvial fans as well as slumps and cut banks.

Table 7. ***Soils with Badlands and Slickspots***

ASSOCIATION	SYMBOL	BADLAND	SLICKSPOT
Reeder-Cabba	4		Yes
Rhoades-Daglum-Reeder	11		Yes
Bullock-Parchin	12	Yes	Yes
MAP UNIT	**SYMBOL**	**BADLAND**	**SLICKSPOT**
Badland	Bb	Yes	
Bullock-Parchin fine sandy loam	BrB		Yes
Bullock-Parchin Slickspots complex	BsB	Yes	Yes
Bullock-Slickspots-Rock outcrop complex	Bv E	Yes	Yes
Rhoades loam	RrA		Yes
Rhoades-Daglum loams	RsB		Yes
Rhoades-Daglum-Slickspots complex	RtB		Yes
Rhoades-Slickspots complex	RuB	Yes	Yes
Rhoades-Slickspots-Rock outcrop complex	RvE	Yes	Yes
Rock outcrop-Cabba complex	RzF	Yes	

The soils in the survey area are mainly aridisols, alfisols, and mollisols. However, *E. visheri* shows a predilection for badlands and slickspots, neither of which show any significant soil development. For a list of soil associations and soil map units that contain badlands and slickspots, see **Table 7**, *Soils with Badlands and Slickspots*.

The survey area is currently used for cattle grazing and is divided into eight grazing allotments.

4) ERIOGONUM VISHERI FINDINGS

POPULATIONS

Totals: This survey recorded a total of 465 populations containing 51065 plants on 84942m² (21.99 acres) of land. Forty of the populations containing 7309 plants corresponded with historic populations. Thus, previously undocumented populations amounted to 425 and contained 43756 plants.

Density: Total area surveyed was 10710 acres, resulting in a population density of 0.043 per acre or 1 population every 23.26 acres. The plant density was 4.77 plants per acre or 1 plant every 0.210 acres. Within the actual area occupied by *E. visheri* plants, the density was 1 plant every 0.601m² or 1.66m² per plant. The plant occupied 0.21% of the total acreage.

These numbers are considerably less than the surveys conducted in 2004. Population density in 2004 was twice as large and plant density was nearly forty times as great. (Schmoller, 2004)

Average: The typical or average population contained 110 plants and covered 182.67 m². These covered 79% of the area and contained 5% of the plants as those found in the 2004 surveys.

Historic populations: Despite a thorough search, one historic population was not relocated. It had been situated near a stock dam and along a draw. The soil had been churned up by cattle. It is likely that the population failed to thrive.

Comparisons: The *Eriogonum visheri* survey of 2004 (Schmoller, 2004) and this survey were conducted in nearly identical habitat, within a few miles of one another. Yet, there were fewer plants, smaller populations, and less plant density in this survey than the survey of 2004. This may be a function of the density suitable habitat. There was much more suitable habitat per acre in the 2004 survey. This may also be a function of the increased heat and drought seen in 2005 and 2006 as compared to 2004.

In this survey, differences could be seen from one year to the next. Plants exhibited poorer stature and vigor in 2006 than in 2005. This may be accounted for by the fact that the summer of 2006 was hotter and drier than that of 2005.

HABITAT

The patterns of habitat preferences and aversions were observed during the course of this survey were identical or consistent with those found in previous surveys (Lenz, 1993; Ode, 1987; Peabody, 1995; Schmoller, 1993; Schmoller, 1995; Schmoller, 2004; Vanderhorst and Heidel, 1998; Vanderpool, 1993). A few observations:

Geology: All *E. visheri* populations found in this survey were situated on Hell Creek or Ludlow formations. More populations were found on Hell Creek than Ludlow formation. No plants were seen on lignite.

Soil: Most often this species grew on badland outcrops or the primary erosional debris of these outcrops. These lack actual soil development. The species shows a strong predilection toward clay. Fifty-three percent of the populations were found in clay, 4% were in sand, and 44% were in gravel. But most gravel and sand were shallow deposits, an inch or two deep, underlain by clay.

The clays favored by E. visheri in this survey had high shrink swell capacity, adverse to root development, which resulted in the spare vegetation structure that favors *E. visheri.* Most often the clays were dense grey to white, those typically found in the alluvial fans at the base of badlands buttes. ***(Figure 2)*** Rarely did it grow in clays with red to orange hues. This coloration may be an evidence of oxides of iron. Specimens were most robust in darker clays. This coloration may be an evidence of higher organic matter content.

Figure 2. Typical *E. visheri* in white clay outwash below badlands butte.

Soils with evidence of extreme selenium, alkali, or saline rarely contained *E. visheri* specimens. The absence of populations on lignite suggests an aversion to sulfur or the lower pH that might accompany coal strata.

Figure 3. Reddish-colored *E. visheri* on sideslope of badlands outcrop.

Geomorphology: Eighty percent of these populations were located on the nearly level alluvial fans at the base of badlands buttes, 36% were found in rivulets descending from the base of the buttes, and 24% were found on sideslopes of the badland butte or erosional debris. Many populations were found on a complex of geomorphologic features. Populations were somewhat evenly divided between original Hell Creek or Ludlow formations or in recent alluvial deposits at the base of Hell Creek or Ludlow badland formations. Specimens were rarely found beyond first order tributaries.

Slope: Slopes were typically level. When found on steeper slopes, they were usually in the midst of gravel or in the cracks within popcorn-weathered clay.

Elevation: Most populations resided between 2300 feet (701m) and 2400 feet (732m) in elevation.

Erosion: All sites experienced high erosion rates typical of badlands geology. This is a function of the poorly consolidated rocks, intense precipitation episodes, and high winds common on the Great Plains. As a result, vegetation is often buried in sediment or uprooted by runoff. Open site conditions result, relatively free of competition and succession. These are the conditions in which *E. visheri* thrives. Accordingly, it was common to find *E. visheri* growing on the banks of rivulets, outwash of badlands buttes, sideslopes of badland outcrops ***(Figure 3)***, or slickspots on the prairie flats.

Figure 4. *Calamovilfa longifolia* in sandy outwash that consistently lacks *E. visheri*.

Vegetation: As in previous surveys, only a few plant species were seen in close association with *E. visheri*, apparently the result of the poor soil development and fertility at these locations. These associates were: *Artemisia cana, Chrysothamnus nauseosus, Gutierrezia sarothrae, Comandra umbellata,* and *Salsola iberica.*

Regardless of favorable soil and geology, negative indicators of *E. visheri* appeared to be *Astragalus racemosus, Atriplex nuttallii, Ceratoides lanata, Eriogonum pauciflorum, Opuntia polyacantha, Polygonum arenastrum. Melilotus officinalis, Schizachyrium scoparium,* the lichen *Hypogymnia physodes,* and *Calamovilfa longifolia.*

Many of these species have chemical or physical tolerances or preferences that suggest conditions or extremes that would exclude *E. visheri*. For example, *Atriplex nuttallii* and *Ceratoides lanata* are tolerant of saline or alkaline conditions. *Hypogymnia physodes* is sulphur dioxide, sodium chloride, and acid tolerant. (Bates, 1990; Hauck, 2006) *Calamovilfa longifolia* prefers sandy sites. ***(Figure 4)*** *Astragalus racemosus* seems to require selenium for their development and so serve as indicators of seleniferous soil areas. (Trelease, 1939)

Vegetation structure usually lacked shrub or tree cover, with bare soil ranging from 50% to 95%. At times the open conditions were the result of cattle trampling.

Aspect: Most populations were found on the relatively level clay outwash at the base of badland buttes, but where populations were on sideslopes, they tended to be on the southeast face. This appears to be the result of the strong northwesterly winds that prevail from fall through spring.

Exposure: All populations and almost every individual specimen were in open light conditions. The occasional plant was found in the shadow of a cutbank, a steep ravine, a boulder, or a shrub.

VIGOR

All plants exhibited good vigor. Occasional trampling, grazing, and chlorosis, were observed. ***(Figure 5)*** No significant parasitism, disease, or molestation of populations was seen. Most plants were smaller in 2006 than in 2005, and it is assumed that this was due to the greater heat and drought seen in 2006.

Figure 5. Grazed or browsed branches of specimen of *E. visheri* .

THREATS

No great threats were seen. Most mortality of *E. visheri* specimens appeared to be due to moisture stress.

Grazing or browsing: Cattle have not shown any significant impacts on populations in past surveys. However, in the 2006 survey, more browsed or grazed plants were seen than in previous years. The species of animal responsible for this was unclear. Numerous Cottontail rabbits (*Silvilagus floridanus*) inhabit the badland buttes. Cattle tracks were in the vicinity. The increased sampling may have been the result of the extreme drought and heat during the summer, resulting in poor forage. Or it may have been the result of a later than usual survey that brought the survey into fall grazing patterns. These patterns may include sampling of *E. visheri* plants.

Noxious weeds: Noxious weeds are seen infrequently in the area. But large acreages of prairie in the same physiographic regions have been ravaged by the likes of *Euphorbia esula*, *Centaurea repens,* and *Circium arvense.* One population of *Circium arvense* was seen on private land 175 meters to the west of the Shambo allotment (T18-R18-S35).

Moisture stress: As in previous surveys, the greatest adverse impact on *E. visheri* populations appears to be from moisture stress. Populations situated on convex slopes or ridgetops were less frequent and less robust. Most skeletal remains of extinct populations were located on ridgetops and convex slopes. ***(Figure 6)*** Additionally, the extreme heat and drought in 2006 may account for reduced stature and expanse of *E. visheri* populations that year. This raises the possibility that *E. visheri* may be another species that would be adversely affected by increased global temperatures.

Figure 6. Skeletal remains of previous year's *E. visheri* on gravelly ridgetop.

Figure 7. Senescent above-ground stem, leaves and capsules of *Talinum parviflorum* amidst leaves of *Opuntia fragilis*.

Figure 8. Closed depression, otherwise known as closed basin or playa, in the Schopp allotment.

Figure 9. Aerial photograph of T18-R17-S24, in the Anderson allotment. Yellow line shows section border. Red line shows 4ha closed depression. Beef Creek, appearing as a green line, lies to the northeast of the closed depression.

4) OTHER FINDINGS

TALINUM PARVIFLORUM

Five populations of *Talinum parviflorum* were found in this survey. ***(Figure 7)*** All were found in the 2005 survey. The absence of *T. parviflorum* in 2006 may due to the greater heat and drought seen in 2006.

SUBIRRIGATED MEADOW

Two subirrigated meadows, or "bogs" are located in the Schopp allotment (T18-R18-S15). These are treacherous sites, with a soupy clay suspended in the artesian waters covered by a thin layer of dried mud and *Juncus balticus*. Survey attempts were invigorating. It is not an exaggeration to say that they possess the ability to swallow a man and his vehicle whole.

SPRINGS

Springs were scattered throughout the survey area. Although eight springs were GPS'd, many other springs were present. Some had been developed. Most were trampled by cattle. Many had saline residue.

CLOSED DEPRESSIONS

Also known as closed basins or playas, these were scattered throughout the entire survey area. ***(Figure 8)*** Nine were found in the Schopp allotment (T18-R18-S9, 10, 15). One large closed depression, visible from aerial photos, approximately 4ha in size, was located in section 24 of the Anderson allotment (T18-R17-S24). ***(Figure 9)***

GARBAGE DUMP

An abandoned garbage dump was located in the Buer allotment (T18-R18-S20). Judging from the nature of the debris, it dated back to the 1930's and had been in use until the 1980's.

UPLAND SANDPIPER

A lone Upland sandpiper (*Bartramia longicauda*) was seen in a draw in the Schopp allotment (T18-R18-S9).

FIRE

Thousands of acres in the western Dakotas burned in the summer of 2006. Some of this acreage fell within the Shambo allotment. As may be expected, due to the sparse vegetation typical of *E. visheri* habitat, fire did not directly impact any populations.

NESTS

Two large stick nests were located within the survey area. One was a ground nest, com-

posed of *Artemisia cana* sticks in the Lyon allotment (T18-R17-S35). ***(Figure 9)*** By all appearances, it was the nest of a Ferruginous hawk (*Buteo regalis*). It was not clear whether it had been active in 2006; no bones or feathers were seen. The other nest was in a small Plains cottonwood tree in the Hofer allotment (T18-R18-S27). ***(Figure 10)*** It was not possible to determine what species occupied that nest.

OFF-SITE E. VISHERI

Scattered *E. visheri* were seen off-site in private land and GRNG lands not included in this survey. The most notable was in the Lyon allotment (T18-R17-S25, SW¼) where hundreds were seen.

CONCLUSIONS AND RECOMMENDATIONS

Conclusion: The entire survey area was inspected in this survey. Nevertheless, it is likely that some populations went undetected. This can be attributed to the undulating, fractured terrain in the survey area. One historic population was not relocated, but the area was searched thoroughly, and it very probable that the population vanished. Scattered *E. visheri* were seen off-site on private land and in GRNG lands not included in this survey.

While the populations found in this survey were not on the scale of those found in 2004, despite being in nearly identical habitat, these populations can be considered one of the largest known concentrations of this rare plant species in its range.

It was evident that no major threat cast its shadow over the populations. The scarcity of human inhabitation, industry, and economic development in the region indicates that anthropogenic factors should remain subdued for the foreseeable future. Current management practices appear to be compatible with the maintenance of *E. visheri* populations. However, as indicated by the diminished stature of populations in heat-ravaged 2006, the threat of global warming to *E. visheri* should not be discounted.

Seeing that *T. parviflorum* populations were located without much effort, the species may be more abundant than expected.

Recommendations: No changes in management practices are recommended. Populations observed in this survey should be revisited periodically to observe trends. The species grows more identifiable as the summer wears on, being most visible in the fall as it turns red. Fall surveys for *E. visheri* would be legitimate. Reports of *E. visheri* on other allotments, other National Forests in the area, and private land compel proactive surveys elsewhere on the GRNG and beyond.

Figure 9. Ground nest constructed of *Artemisia cana* sticks. Probably constructed by Ferruginous hawk.

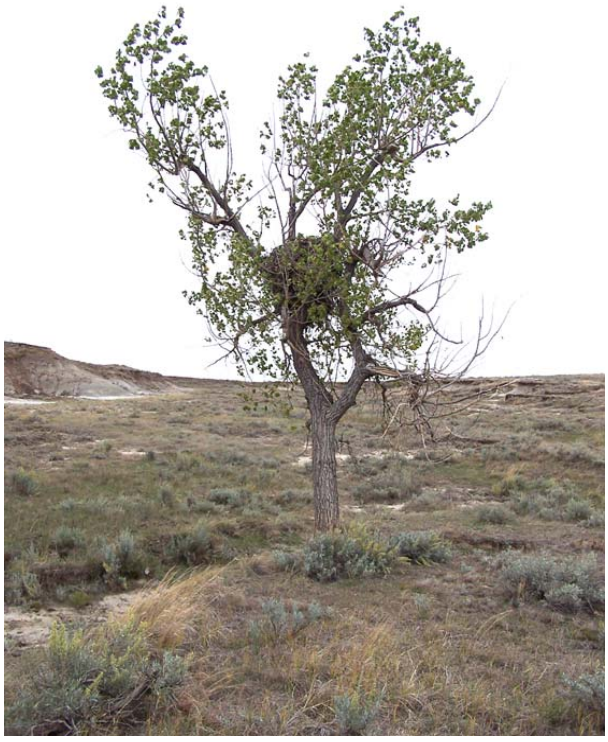

Figure 10. Tree nest, built in *Populus deltoides*. Raptor identity unknown.

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