2009

2009 Astragalus barrii Barneby (Barr's Milkvetch) Survey on the Oglala National Grassland for the Nebraska Game and Parks Commission and Nebraska National Forest

Grace M. Kostel

2009 *Astragalus barrii* Barneby (Barr's Milkvetch) Survey on the Oglala National Grassland for the Nebraska Game and Parks Commission and Nebraska National Forest

Grace M. Kostel, BHSU Herbarium, 1200 University Street, Spearfish, SD 57799

Astragalus barrii Barneby (Barr's milkvetch) is ranked globally vulnerable (G3) by NatureServe and critically imperiled (S1) by the Nebraska Natural Heritage Program. *A. barrii* is designated a sensitive species by the USDA Forest Service (USFS) Region 2 (R2). The Oglala National Grassland (ONG), located in northwestern Nebraska in Dawes and Sioux County, is within the USFS R2 jurisdiction. The purpose of this survey was to: (1) search for and document all *A. barrii* present on designated areas of the ONG and (2) collect data on rare plant species and high quality native plant community occurrences.

Methods

Areas to be surveyed on the ONG were selected and prioritized by USFS staff (Steinauer pers. comm.) and are shown on Figure 1. The survey sites were delineated on Dawes and Sioux County Soil Survey and satellite imagery maps and provided in advance of the fieldwork. USGS 7.5-minute topographic quad maps were used during field survey.

Figure 1. Areas on the Oglala National Grassland surveyed for *Astragalus barrii* Barneby (Barr's milkvetch) during May of 2009 with survey areas outlined in blue.

A. barrii typically flowers from late April to mid-June and peaks in May. A large population of *A. barrii* at Limestone Butte east of Oelrichs, SD on the Buffalo Gap National Grassland was inspected and photographed (Figure 2) to verify the appropriateness of the chosen survey period. Prime flowering had commenced by mid-May 2009, thus walking surveys, or meander searches, were conducted daily beginning May 12 and continued through May 21 within the predefined areas. Surveys often also included adjacent areas. Nebraska Natural Heritage Program Rare Plant Survey Forms and Ecological Community Survey Forms were completed to document rare plant (S1 or S2 species) and high quality native plant community occurrences, respectively. Plant community nomenclature follows Steinauer and Rolfsmeier (2003). Vascular plant nomenclature follows Kaul *et al*. (2006) except for *Hymenoxys richardsonii*, which follows the nomenclature of Dorn (2001).

Figure 2. *Astragalus barrii* Barneby (Barr's milkvetch) in bloom at Limestone Butte near Oelrichs, South Dakota during mid-May on the Buffalo Gap National Grassland on rocky clay soil.

Results

Astragalus barrii

No Barr's milkvetch populations were found during this survey on the ONG. Though locally abundant in areas of nearby South Dakota and Wyoming, just one known population of Barr's milkvetch is known from northeast Nebraska despite the presence of

what appears to be large areas of potential habitat. The one known population occurs on private land in Dawes County northeast of Chadron (Muenchau *et al.* 1991).

Plant Communities

The following four native plant communities were documented on the ONG: Badlands (CEGL002050), Northwestern Mixedgrass Prairie (CEGL001579), Western Mixedgrass Prairie (CEGL002037) and Sandbar Willow Shrubland (CEGL001203, CEGL008562). Brief descriptions of the plant communities, as these occur on the ONG, are presented below. More detailed, statewide descriptions are provided in Steinauer and Rolfsmeier (2003).

Badlands (Eroding Great Plains Badlands)

Range: This community occurs in Dawes, Scottsbluff and Sioux counties in the Nebraska Panhandle.

Condition: The sparsely vegetated nature of this community, and its association with the often steep, inaccessible geologic landforms frequent on the ONG, protect it from heavy use by livestock, thus vegetative cover on scattered level washes frequently can be dense. Typical grasses include *Pascopyrum smithii* (western wheatgrass), *Elymus lanceolatus* (thickspike wheatgrass) and *Poa secunda* (curly bluegrass). Typical forbs include *Eriogonum pauciflorum* (few-flower wild-buckwheat), *Monolepis nuttalliana* (poverty weed), and *Astragalus tenellus* (pulse milkvetch). Others such as *Astragalus racemosus* (poison milkvetch), *Oxytropis sericea* (silky locoweed), *Atriplex* spp. (saltbush) and *Ericameria nauseosa* (rubber rabbitbrush) are also occasionally present. Weedy species found in this habitat are *Melilotus officinalis* (sweetclover), in the more moist sites, and *Bromus tectorum*, *B. arvensis* (cheatgrasses) and *Salsola* spp. (Russian thistle). *Halogeton glomeratus* (salt lover) seedlings were found scattered throughout several sites (see Ecological Community Survey Forms for detailed locations), and have the potential to become invasive.

Threats: In addition to invasive species such as *Halogeton glomeratus*, other threats to badlands habitat and its flora on the ONG include off-road vehicle (ORV) use. Figures 3 and 4 illustrate examples of the ecological damage caused by ORV use on the ONG.

Rare Species: *Mertensia lanceolata* (prairie bluebells) S2; *Fritillaria atropurpurea* (leopard lily) S2; *Elymus spicata* (bluebunch wheatgrass) S1

Notes: Spring rains provided abundant moisture and the leopard lilies had four and up to as many as seven flowers per stem (see photographs included with the materials of the report).

Exemplary Sites: Sand Creek Allotment, Pasture 38; Benedict Buttes Area, Pasture 39W (pasture area NE of BNSF Railroad only)

Figure 3. Photo of off-road vehicle tracks in Sand Creek Allotment (Pasture 38) causing ecological damage. These tracks passed directly through a population of *Fritillaria atropurpurea* (leopard lily), which can be seen flowering in the mid-upper right of the photograph.

Figure 4. Close-up of Figure 3 with white arrows indicating several *Fritillaria atropurpurea* (leopard lily) plants destroyed by off-road vehicle passing directly through the plant population.

Western Mixedgrass Prairie (Needle-and-Thread-Blue Grama Mixed-grass Prairie)

Range: This community is common over most of the Nebraska Panhandle with the exception of the extreme northwest.

Conditions: *Bouteloua gracilis* (blue grama), *Bromus arvense*, *B. tectorum* (cheatgrasses) and *Vulpia octoflora* (six-week fescue) were common in this type indicating past heavy use and/or drought conditions. Where healthier examples of this type were found (see Ecological Community Survey Forms for information), *Nassella viridula* (green needlegrass), *Hesperostipa comata* (needle-and-thread), *Poa secunda* (curly bluegrass), and *Pascopyrum smithii* (western wheatgrass) were present and co-occurred. This type is rare in extreme northwest Nebraska and represented only by isolated occurrences that may be explained by locally available moisture, topography that has limited the accessibility of the site to grazers or careful management.

Threats: Drought, heavy grazing, climate change, suppression of fire.

Historically many sites within this community were degraded by overgrazing. Species diversity in heavily grazed sites is low; although, in ungrazed sites diversity can be equally low, thus moderate, managed grazing with natural and managed fire regimes may increase species diversity.

Rare Species: *Mertensia lanceolata* (prairie bluebells) S2

Exemplary Sites: Pasture 16B ESE of Warbonnet Battlefield Area (Montrose, NE)

Northwestern Mixedgrass Prairie

Range: This community occurs in the Hat Creek and White River basins in Dawes, Sheridan and Sioux counties in extreme northwestern Nebraska.

Condition: This is the most common upland plant community on the ONG. *Pascopyrum smithii* (western wheatgrass), *Poa secunda* (curly bluegrass) with an understory of *Bouteloua gracilis* (blue grama) and *Bouteloua dactyloides* (buffalograss) describe the most common elements of this community. Where soils are thinner due to rock, and/or xeric conditions prevail, or where past overgrazing has occurred, blue grama and buffalograss become more apparent. *Carex filifolia* (threadleaf sedge), *Nassella viridula* (green needlegrass), and (less often) *Hesperostipa comata* (needle-and-thread) are also present. Typical shrubs, albeit uncommon, include *Artemisia cana* (silver sage) and *A. tridentata* (big sage). *Yucca glauca* (soapweed), *Artemisia frigida* (fringed sage), *Opuntia polyacantha* (spine-fruit prickly pear) and *Astragalus drummondii* (Drummond's milkvetch) can also be present. This type can trend toward the **Shortgrass Prairie (*Bouteloua gracilis—Bouteloua dactyloides* Herbaceous Vegetation)** but the trend was not encountered during this survey. On the ONG, the **Northwestern Mixedgrass Prairie** community was the most common community adjacent to the **Badlands**.

Threats: Drought, heavy grazing, climate change, suppression of fire.

Kostel (2006), while performing a floristic inventory of the area, noted the presence of *Poa bulbosa* (bulbous bluegrass) in scattered amounts. Currently, the species was present in this community to the extent that it seems to have become invasive. The abundant moisture this spring may have contributed to this condition. Kaul *et al*. (2006) noted the presence of *P. bulbosa* from collections at CSCN from the early 1970s and stated that the species is "apparently not persisting for long at any one location".

Rare Species: *Mertensia lanceolata* (prairie bluebells) S2

Exemplary Sites: N/A as areas are heavily infested with cheatgrasses and, currently, bulbous bluegrass.

Sandbar Willow Shrubland

Range: This community is found primarily along rivers and streams throughout the state.

Condition: Natural disturbance common to this community is in the form of flood events due to locally heavy rainfall and there is litter accumulation present that is likely due to such flood events. The community follows the Sand Creek drainage and is predominately on the west side of the Burlington Northern/Santa Fe Railroad as it runs along Toadstool Road. *Salix exigua* (sandbar willow), *Amorpha fruticosa* (false indigobush), *Elymus canadensis* (Canada rye), *Pascopyrum smithii* (western wheatgrass), *Nassella viridula* (green needlegrass) and *Solidago* (goldenrods) spp. are present. *Melilotus officinalis* (sweetclover) has invaded the area. The community begins to trend toward **Silver Sagebrush Shrub Prairie w**here Sand Creek begins to widen and broaden into the upland but the trend is abruptly terminated by the badlands habitat and steep geology of the area. Thus, shrubs included in the community type are *Artemisia cana* (silver sage) and *Yucca glauca* (soapweed).

Threats: Drought, heavy grazing, invasive species.

Rare Species: N/A

Exemplary Sites: N/A

Rock Outcrop?

Several areas of rock outcrops were encountered during the survey. These areas did not fit neatly into categories of rock outcrop communities included in Steinauer and Rolfsmeier (2003). One such was the scoria bed (often called "clinker") east of Warbonnet, and another was rockbed east of Sugarloaf Butte and east of Twin Buttes. Each is further described below.

Scoria
Southeast of Warbonnet, a scoria-like area of red rock that may have resulted from a historical mining attempt is present. The site contained all aspects and slope from zero to 45 degrees. The site is open and contained a number of seleniferous species, *i.e., Astragalus bisulcatus* (two-groove poison milkvetch), *Oxytropis* spp. (locoweed) and *Oonopsis multicaulis* (cutleaf goldenweed). A preponderance of *Chenopodium* (lambsquarters) spp. was noted, as was *Artemisia tridentata* (big sage). Most unusual was the fact that no invasive species were noted as present, at least at this early season.

Rockbeds
A site east of Sugarloaf Butte and two sites at various distances east of Twin Buttes were noted to have high cover of *Artemisia tridentata* (big sage; 0-50%) and species diversity was high with very little to no invasive species present. One of two sites east of Twin Buttes was especially floristically rich in milkvetch species, *i.e.*, *Astragalus missouriensis* (Missouri milkvetch), *A. spatulatus* (tufted milkvetch), *A plattensis* (Platte milkvetch), *A. laxmannii* (standing milkvetch), and *A. crassicarpus* (groundplum). In addition, *Eriogonum pauciflorum* (few-flower wild-buckwheat), *Cryptantha* spp, *Oxytropis lambertii* (Lambert's crazyweed), *Lesquerella* spp., *Tetraneuris acaulis* (stemless Tetraneuris), *Penstemon gracilis* (slender beardtongue), *Gutierrezia sarothrae* (broom snakeweed), and *Arenaria hookeri* (Hooker's sandwort) were present. A native plant species new to Nebraska, *Hymenoxys richardsonii*, was found at this site. Publication of the discovery is pending.

Rare Vascular Plant Species

Four species of rare vascular plants from four families were recorded during the survey. These species are by no means a comprehensive analysis of rare plants in these habitats on the ONG as few vascular plant species are phenologically advanced for identification in early spring. A list of rare species with relative abundance and habitat is provided in Table 1 and Appendix A.

Discussion and Summary

The Oglala National Grassland lies within the geographic region known as the White River Badlands, which is characterized by the physical habitat (geology, soils, and topography) typically associated with *A. barrii*. Yet, the species has not yet been found on the ONG. Whereas Dingman (2005) found *A. barrii* to prefer soils of high clay with a surface of chalcedony cobble in the Badlands National Park, the same habitat characteristics of the White River Badlands of the ONG fail to yield occurrences of the species. Additionally, Dingman noted *A. barrii* to have a *particular* affinity for soils of high clay with a *silty* component. She hypothesized that the silt characteristic provided an additional element for both water retention and sufficient thermal permeability for early Spring warm-up, which created optimal conditions for growth. The badland soils of the White River Badlands within the ONG are characterized by a typical profile of silty clay loam from 0-5 inches and clay from 5-17 inches. These are followed by weathered bedrock at 17-60 inches, whereas some of the badland soils of the Buffalo Gap National Grassland (BGNG) where *A. barrii* occurs have a typical profile of silty clay loams to a depth of up to 60 inches (Soil Survey Staff 2009).

Several attempts to locate Barr's milkvetch in Nebraska have been undertaken by USFS and USFS contracted efforts, *i.e.*, Muenchau *et al.* 1991 in addition to the present survey. However, no comprehensive study for the edaphic requirements of *A. barrii* has ever been initiated or undertaken. These and other unanswered biological and ecological uncertainties were detailed in a comprehensive USFS R2 Species Conservation Assessment prepared for *Astragalus barrii* by Ladyman in 2006, and remain unanswered. In addition, a comprehensive conservation plan has yet to be developed.

Ladyman (2006) summarized that "understanding the reproductive system and the genetic variability of *Astragalus barrii* would permit the making of biologically informed management decisions for long-term conservation". This genetic element and the associated edaphic variability of *A. barrii* populations in Montana, Nebraska, South Dakota and Wyoming may explain the puzzling absence of the species from the vast area of what appears to be suitable habitat on the ONG. Additionally, given the vast area and the rugged nature represented by the ONG, it is always possible that a very small remnant population or, alternatively, a very small founder population is indeed on the ONG, but has not been located. Continued surveys are highly recommended, as the area remains understudied (Great Plains Flora Association 1986, Kostel 2006).

Table 1. Plant communities and rare species found at each survey site and the EO rank for each occurrence.

Survey Site	Communities	EO Rank	Rare Species	S Rank
USFS ONG Pasture 40E	Badlands	B	N/A	N/A
USFS ONG Pasture 40E	NW Mixedgrass Prairie	B	N/A	N/A
USFS ONG Pasture 41	Badlands	C	N/A	N/A
USFS ONG Pasture 41	NW Mixedgrass Prairie	C	N/A	N/A
USFS ONG Pasture 39W	Badlands	A	*Mertensia lanceolata*	S2
USFS ONG Pasture 39W	NW Mixedgrass Prairie	B	N/A	N/A
USFS ONG Pasture 39W-West RRoad	Badlands	C	N/A	N/A
USFS ONG Pasture 39W-West RRoad	NW Mixedgrass Prairie	C	N/A	N/A
USFS ONG Pasture 39W-West RRoad	Sandbar Willow Shrubland	C	N/A	N/A
USFS ONG Pasture 22A	Rock Outcrop	A**?**	*Hymenoxys richardsonii*	Species new NE
USFS ONG Pasture 22A	NW Mixedgrass Prairie	B	N/A	N/A
USFS ONG Pasture 31E	Rock Outcrop	B**?**	N/A	N/A
USFS ONG Pastures 32, 33A, 33D	Badlands	A*****	*Fritillaria atropurpurea; Elymus spicatus*	S2; S1
USFS ONG Pastures 32, 33A, 33D	NW Mixedgrass Prairie	A*****	N/A	N/A
USFS ONG Pasture 16B	Scoria?	A**?**	N/A	N/A
USFS ONG Pasture 16B	(NW) Mixedgrass Prairie	A	*Mertensia lanceolata*	S2
USFS ONG Pasture 38W	Badlands	A	N/A	N/A
USFS ONG Pasture 38W	NW Mixedgrass Prairie	A	N/A	N/A
USFS ONG Pasture 37	Badlands	A	N/A	N/A
USFS ONG Pasture 37	Buckbrush Shrubland	C	N/A	N/A
USFS ONG Pasture 37	NW Mixedgrass Prairie	C	N/A	N/A

? = Community does not fit description in Terrestrial Natural Communities of Nebraska; ***** = see Community Ecological Descriptions for further comments

References

Dingman, S. 2005. Habitat and Life History Characteristics of *Astragalus barrii* (Fabaceae) in the South Dakota Badlands. Master's Thesis, University of South Dakota, Vermillion.

Dorn, R.D. 2001. Vascular Plants of Wyoming. 3rd Ed. Mountain West Publishing, Cheyenne, WY.

Great Plains Flora Association. 1986. Flora of the Great Plains. University of Kansas Press, Lawrence.

Kaul, R.B., D. Sutherland and S. Rolfsmeier. 2006. The Flora of Nebraska. University of Nebraska-Lincoln.

Kostel, G.M. 2006. A Vascular Plant Survey of the Buffalo Gap National Grassland (South Dakota) and the Oglala National Grassland (Nebraska) and Vicinity. Master's Thesis, University of Wyoming, Laramie.

Ladyman, J.A.R. 2006. *Astragalus barrii* Barneby (Barr's milkvetch): A Technical Conservation Assessment, prepared for the USDA Forest Service, Rocky Mountain Region, Species Conservation Project.

Muenchau, B.L., M.F. Webster, J.P. Hardy and R.R. Weedon. 1991. Status surveys for Barr's milkvetch and Dakota buckwheat on the Fall River District, Buffalo Gap National Grassland, South Dakota. Unpublished report submitted 13 June 1991 to the USDA Forest Service, Nebraska National Forest, Hot Springs, SD, USA.

Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. Available online at http://websoilsurvey.nrcs.usda.gov/ accessed [4/19/2009].

Steinauer, G. and S. Rolfsmeier. 2003. Terrestrial Natural Communities of Nebraska. Ver. 3. Nebraska Natural Heritage Program, Nebraska Game and Parks Commission, Lincoln, NE.

Appendix A
Rare Plant Species List
Oglala National Grassland *Astragalus barrii* Survey 2009

Abbreviations: badl = badlands; nwmixed = Northwestern Nebraska Mixedgrass Prairie; westmixed = Mixedgrass Prairie; rock = rockbed

Asteraceae

Hymenoxys richardsonii (Hook.) Cock. (pimpernel) rare (?) in rock

Boraginaceae

Mertensia lanceolata (Pursh) A. DC. (prairie bluebells) occasional in badl; westmixed; nwmixed

Liliaceae

Fritillaria atropurpurea Nutt. (leopard lily) occasional in badl

Poaceae

Elymus spicata (Pursh) Gould (bluebunch wheatgrass) rare in badl