WESTERN GREAT PLAINS CLIFF, OUTCROP, AND SHALE BARRENS

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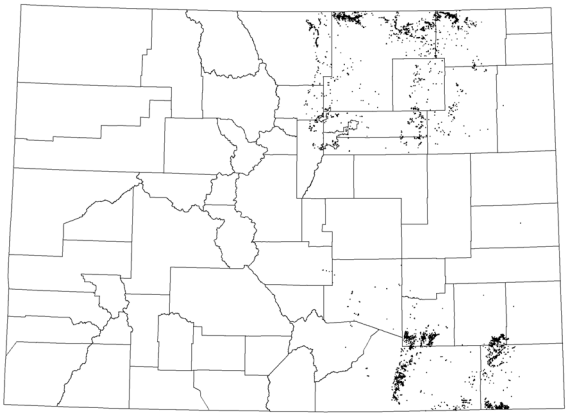

extent exaggerated for display

ARENARIA HOOKERI BARRENS HERBACEOUS ALLIANCE
- *Arenaria hookeri* Barrens Herbaceous Vegetation

FRANKENIA JAMESII DWARF-SHRUBLAND (PROPOSED)
- *Frankenia jamesii / Achnatherum hymenoides* [undescribed]
- *Glossopetalon spinescens* var. *meionandrum - Frankenia jamesii* [undescribed]

JUNIPERUS MONOSPERMA WOODLAND ALLIANCE
- *Juniperus monosperma / Bouteloua curtipendula* Woodland
- *Juniperus monosperma / Bouteloua eriopoda* Woodland
- *Juniperus monosperma / Bouteloua gracilis* Woodland
- *Juniperus monosperma / Cercocarpus montanus - Ribes cereum* Woodland
- *Juniperus monosperma / Hesperostipa neomexicana* Woodland

OPEN CLIFF SPARSELY VEGETATED ALLIANCE
- Limestone Butte Sparse Vegetation
- Sandstone Butte Sparse Vegetation
- Sandstone Dry Cliff Sparse Vegetation
- Sandstone Great Plains Dry Cliff Sparse Vegetation
- Sandstone Great Plains Xeric Butte - Bluff Sparse Vegetation

PRUNUS VIRGINIANA SHRUBLAND ALLIANCE ??

RHUS TRILOBATA SHRUB HERBACEOUS ALLIANCE
- *Rhus trilobata* Rocky Mountain Shrub Herbaceous Vegetation

ROCK OUTCROP SPARSELY VEGETATED ALLIANCE
- Shale Barren Slopes Sparse Vegetation
- Siltstone - Sandstone Rock Outcrop Sparse Vegetation

Overview: This system includes cliffs, outcrops, breaks and barrens throughout the Western Great Plains. In the northern Central Shortgrass Prairie ecogregion, this system includes rimrock and erosional remnants of the High Plains escarpment stretching for many miles north of the South Platte River, as well as other isolated buttes and outcrops to the south. In the southwestern portion of the ecoregion, occurrences of this system are most often found Cretaceous bedrock of the Middle and Upper Chalk members of the Smoky Hills Member of the Niobrara Formation.

Characteristic species: Cliffs and outcrops support a variety of plant communities, depending on the steepness, exposure, and soil conditions of the site. The tops of the escarpment are often dominiated by the adjacent shortgrass or mixedgrass prairie communities. Vegetation of the cliffs and outcrops is typically sparse, and often restricted to shelves, cracks and crevices in the rock, or other areas where soil accumulation allows growth. The lack of vegetation on many sites protects them from fire, and in a few instances the rocky cliffs support disjunct populations of foothills species such as *Pinus ponderosa, Juniperus scopulorum, Pinus flexilis,* and *Cercocarpus montanus*. Sheltered areas on the bluff slopes typically support sparse shrub cover of *Rhus trilobata, Prunus virginiana, Ribes* spp., *Artemisia filifolia, Gutierrezia sarothrae, Opuntia polyacantha,* and *Yucca glauca*, along with prairie grasses such as *Bouteloua gracilis, Aristida longiseta, Hesperostipa comata*, *Bouteloua curtipendula*, *Calamovilfa longifolia* and *Vulpia octoflora*. Claystone and limestone layers within the sandstone form gravelly barrens that support a characteristic “cushion plant”

community that typically includes *Arenaria hookeri, Oenothera caespitosa, Phlox hoodii, Tetraneuris acaulis, Astragalus sericoleucus*, and other species typical of the nearby grasslands. These barrens are also home to the regionally rare plants *Lomatium (Aletes) nuttallii, Cryptantha cana* and *Parthenium (Bolophyta) alpinum*.

Vegetation of the shale barrens is characterized by a "cushion plant" community, with cover less than 25%, and often much lower. Some occurrences may support a sparse overstory of *Juniperus monosperma.* Typical shrub species are *Frankenia jamesii, Glossopetalon spinescens* var. *meionandrum, Atriplex canescens*, and *Artemisia bigelovii.* Perennial low-growing forbs and sub-shrubs include *Tetraneuris acaulis, Eriogonum* spp., *Oxybaphus rotundifolius, Lesquerella fendleri*, *Chamaesyce glyptosperma, Townsendia hookeri, Melampodium leucanthum*, *Zinnia grandiflora, Crypthantha* spp., and *Oönopsis foliosa*. Occurrences may include low cover of bunchgrasses such as *Hesperostipa neomexicana, Achnatherum hymenoides*, *Aristida purpurea,* and *Bouteloua* spp.. As this community grades into adjacent communities in more sheltered areas below ridgetops, cover and plant height increases.

Environment: Topography of cliffs and outcrops ranges from steep rocky bluffs below the escarpments and buttes with intervening swales or gullies to smaller breaks and barrens with gentle slopes. The Ogallala, Arikaree, and White River Formations are the most common cliff and outcrop forming substrates, consisting primarily of sandstones of varying hardness, and often interspersed with limestone, ashy claystone, or volcanic tuff. Shale barrens of the Niobrara Formation are also found near the mountain front.

R. Rondeau

Barrens are generally found on shales, soft limestone (chalk), or shale-derived soils, and are characterized by a high percentage of open, rocky ground between the low-growing shrubs and herbaceous cover. Some occurrences have an overstory of sparse juniper, and may include scattered larger shubs and bunchgrasses. Shale substrates often form a rocky "pavement" between plants. For shale barrens, slope angles range from flat on summits to moderately steep on side slopes, and exposures are variable, depending on how uplift, regional erosion, or downcutting has occurred (Kelso 1999). Soils belong to the Penrose series and are typically shallow. Summit flats have shallower soils than slopes, with slope bottoms generally deeper than slope tops (Kelso 1999). In the southern portion of the Western Great Plains, occurrences of this system may be inclusions in the Southwestern Great Plains Canyon ecological system complex.

Dynamics: Drought and wind erosion are the most common natural dynamics affecting this system.

Variation: Substrates are variable from north to south, and can include sandstone, limestone, clay, siltstone, and shale. Vegetation patterns are also variable across the range of the system, and species composition changes with changing latitude.

Kelso, S. 1999. A Comparative Study of the Shale Barrens Flora on the Niobrara Formation in Southeastern Colorado. Report to the Colorado Natural Areas Program.

Rank:	A	B	C	D
① CONDITION				
Community structure	Native plants dominate the occurrence.		Altered species composition is usually noticeable.	
Non-native spp.	<1% relative cover.	<3% relative cover.	Usually present but not dominant except in small patches.	
Disturbance	Fragmentation from roads or human development is non-existent or occurs on the edge of the occurrence.	Fragmentation from roads or human development, if present, is limited to a small area that occupies less than 0.5% of the occurrence.	Fragmentation from roads or human development (e.g., oil and gas) are frequent enough to cause an increase in non-native plants, soil compaction, and soil erosion.	Human induced disturbance to the barrens is greater than 30% of occurrence.
Natural processes	Natural disturbances such as erosion are occuring on a natural time frame, and are not accelerated by anthropogenic activities.			
② LANDSCAPE CONTEXT				
Surrounding land	The occurrence captures the characteristic ecological gradients (including nested patch communities, e.g. washes, saltbush scrub flats) and geomorphic processes, and the occurrence is completely surrounded by other high quality communities. Little altered by agriculture or development (>90% natural).	The occurrence captures the characteristic ecological gradients and geomorphic processes, and is surrounded by other natural communities of at least moderate quality, such as areas that may have been used extensively for grazing or military training currently or in the past. Somewhat altered by agriculture or development (70-90% natural).	Surrounding landscape is a mosaic of agricultural or semi-developed areas with natural or semi-natural vegetation. Adjacent systems surrounding occurrence are fragmented by alteration (20-70% natural).	The area around the occurrence is entirely, or almost entirely, converted to agricultural or urban land use; occurrence is at best buffered on one side by natural communities. The surrounding landscape is primarily intensive agriculture or urban development.
Connectivity	Highly connected to surrounding landscape; retains species interactions and natural processes occurring across communities.	Moderately connected.	Moderately fragmented and isolated, with limited connectivity to other characteristic natural communities.	Highly fragmented and isolated.
③ SIZE				
Acres	>500	100-500	10-100	< 10