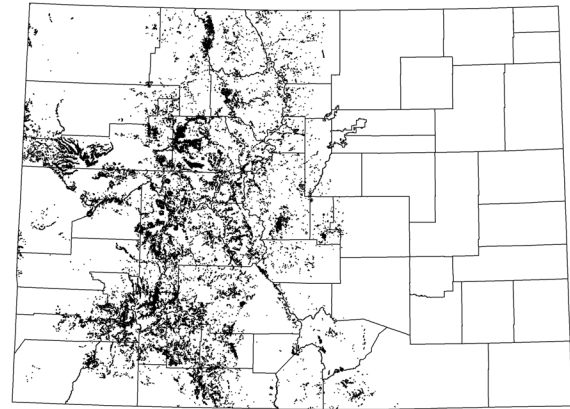


ROCKY MOUNTAIN CLIFF, CANYON AND MASSIVE BEDROCK



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extent exaggerated for display

- ABIES CONCOLOR WOODLAND ALLIANCE
 - Abies concolor* / *Holodiscus dumosus* Scree Woodland
 - Abies concolor* / *Jamesia americana* Scree Woodland
- ALETES ANISATUS HERBACEOUS ALLIANCE
 - Aletes anisatus* - *Scutellaria brittonii* Scree Herbaceous Vegetation
- HEUCHERA BRACTEATA HERBACEOUS ALLIANCE
 - Heuchera bracteata* - *Heuchera parvifolia* var. *nivalis* Herbaceous Vegetation
- JAMESIA AMERICANA SHRUBLAND ALLIANCE
 - Jamesia americana* Rock Outcrop Shrubland
- PICEA ENGELMANNII SPARSELY VEGETATED ALLIANCE
 - Picea engelmannii* / *Saxifraga bronchialis* Scree Sparse Vegetation
- PINUS PONDEROSA WOODLAND ALLIANCE
 - Pinus ponderosa* / *Ribes inerme* Scree Woodland
- PSEUDOTSUGA MENZIESII WOODLAND ALLIANCE
 - Pseudotsuga menziesii* / *Holodiscus dumosus* Scree Woodland
- RIBES CEREUM SHRUBLAND ALLIANCE
 - Ribes cereum* / *Leymus ambiguus* Shrubland
- RUBUS IDAEUS SSP. STRIGOSUS SHRUBLAND ALLIANCE
 - Rubus idaeus* Scree Shrubland
- SAXIFRAGA RIVULARIS HERBACEOUS ALLIANCE
 - Saxifraga rivularis* Herbaceous Vegetation

Overview: This ecological system is found from foothill to subalpine elevations and includes barren and sparsely vegetated landscapes (generally <10% plant cover) of steep cliff faces, narrow canyons, and smaller rock outcrops of various igneous, sedimentary, and metamorphic bedrock type. Also included are unstable scree and talus slopes that typically occur below cliff faces. Soil development is limited, as is herbaceous cover.

Characteristic species: There may be small patches of dense vegetation, but it typically includes scattered trees and/or shrubs. Characteristic trees includes *Pseudotsuga menziesii*, *Pinus ponderosa*, *Pinus flexilis*, *Populus tremuloides*, *Abies concolor*, and *Abies lasiocarpa*, or *Pinus edulis* and *Juniperus* spp. at lower elevations. There may be scattered shrubs present such as *Jamesia americana*, *Mahonia repens*, *Rhus trilobata*, *Amelanchier alnifolia*, and species of *Holodiscus*, *Ribes*, *Physocarpus*, *Rosa*, and *Juniperus*. Cliffs can provide the primary habit for some plant and animal species, such as *Gilia penstemonoides*, *Draba smithii*, and peregrine falcon.

Environment: Larson et al. (2000) define three basic parts of a cliff habitat: 1) the relatively level plateau at the top, 2) the vertical or near-vertical cliff face, and 3) the pediment or talus at the bottom of the face. These three elements share some physical characteristics, are linked by similar ecological processes, and often support the same plants and animals (Larson et al. 2000). Within the larger cliff habitat, steep slopes, small terraces ledges, overhangs, cracks and crevices often form a

mosaic of microhabitat types that appears to be the primary factor contributing to cliff biodiversity (Graham and Knight 2004). In addition, the cliff rim is often windier than the surrounding plateau, providing a distinct microhabitat that differs from the nearby flatter areas. At cliff faces there is less hydraulic pressure retaining water within the rock, so liquid water is more consistently found than in the surrounding habitat types (Larson et al. 2000).

Dynamics: Cliffs and bedrock outcrops are a habitat that is relatively free of anthropogenic disturbance, but the canyons where these often occur are rarely without roads. Human disturbance to this system may include road construction and maintenance, recreation (climbing), and the effects of mining. Erosion by wind, water, and the force of gravity is the primary natural disturbance process in the cliff environment. The rate of erosion and the size of eroded rock particles have a strong influence over which organisms occur on cliffs and talus (Larson et al. 2000).

Variation: Cliff environments are shaped by the parent rock type and strength, climate, aspect, and the weathering patterns produced by physical and chemical processes. Physical weathering includes the downward movement of rock and soil under the influence of gravity (mass wasting), including larger slips, slides and rockfalls, shrinking/swelling in response to changes in water content (mostly in shales and mudstones), direct pressure effects from the formation of ice and mineral crystals, thermal stress, and frost action (Larson et al. 2000). Chemical weathering in cliff environments is directly controlled by precipitation amount and chemistry, rock temperature, and the chemical composition of the rock. Chemical weathering is most prevalent under conditions of higher temperature and high precipitation, whereas physical weathering is more important at lower temperatures (Larson et al. 2000).

Graham, L. and R.L. Knight. 2004. Multi-scale comparisons of cliff vegetation in Colorado. *Plant Ecology* 170:223-234.

Larson, D.W., U. Matthes, and P.E. Kelly. 2000. *Cliff Ecology : Pattern and Process in Cliff Ecosystems*. Cambridge University Press. 340 pp

Rank:	A	B	C	D
① CONDITION				
Community structure	Dominated by native species.		Unnatural erosion, compaction, and altered species composition is usually noticeable.	
Natural processes (landslides, rockfalls, etc.)	Can occur on a natural time frame.		Present, may be altered.	
Non-native species	Absent or < 1% cover.	May be present, but <3% cover.	Usually present, but not dominant except in small patches.	Present.
Anthropogenic disturbance	Fragmentation from roads or human development is non-existent or only on the edge of the occurrence. Breeding and roosting of cliff-nesting birds is not disrupted.	Fragmentation from roads or human development, if present, is limited to a small area of less than 0.5% of the occurrence.	Fragmentation from roads or human development is frequent enough to cause an increase in non-native plants.	Greater than 30% of occurrence.
② LANDSCAPE CONTEXT				
Connectivity	Highly connected.	Moderately connected.	Moderately fragmented.	Highly fragmented.
Surrounding land	Largely intact natural vegetation, with species interactions and natural processes occurring across communities.	Moderately intact natural vegetation, with species interactions and natural processes occurring across many communities; landscape includes partially disturbed natural or semi-natural communities, some of it not high quality due to overgrazing or recent logging.	Largely a combination of cultural and natural vegetation, with barriers between species interactions and natural processes across natural communities; occurrence is surrounded by a mix of intensive agriculture and adjacent forest lots (total area no smaller than ten times the minimum "C"-rated size).	Entirely, or almost entirely, surrounded by agricultural or urban land use; occurrence is at best buffered on one side by natural communities.
③ SIZE				
Acres	>600	200-600	100-200	< 100