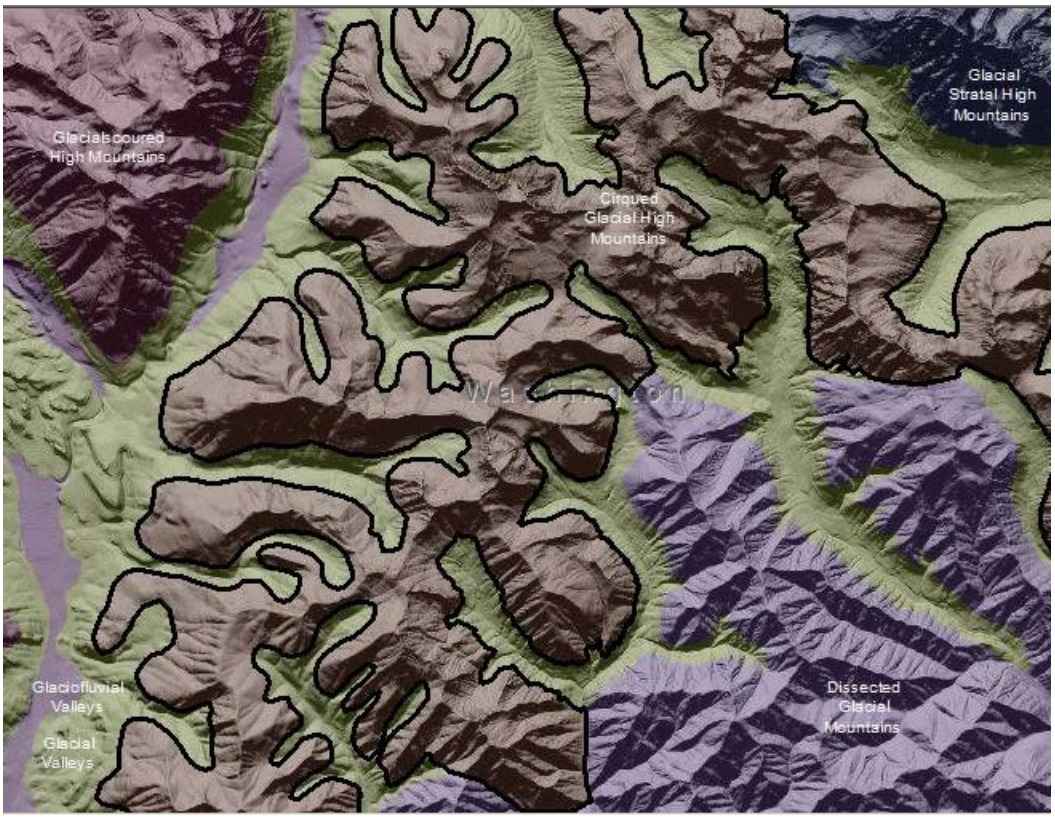
North Cascades Cirqued Glacial High Mountains

Terrain Class: Mountains - No one process responsible for construction of mountains. They can be uplifted, tectonic, subduction of plates, folding, uplift, up and down warping of the mantle, inflation of molten lower crustal (batholiths), etc. Erosion of mountain systems occurs over time. The rate of erosion is dependent on the geomorphic process, the underlying rock structure, and the climate, including both freeze thaw and the amount and intensity of precipitation and runoff. Mountains are further defined and distinguished based on morphology, including the pattern and density of drainages, depth of drainages, overall morphology of the area between the drainages, evidence of a strong imprint of a surficial process such as glaciation, and presence of visible underlying rock structure.

Mountains have simple to very complex forms that have arisen due to inherited rock structure, rock history, and are the net result of local to regional spatial scales of competing rates of upbuilding/uplift and downgrading/erosion. Mountains will have an inherited history from weathering and degradation of the underlying stack of earth materials that forms them. Vegetation, habitat, water interception, collection and transport will share a similar history in the same type of uplift and rock.

Landform Association: Cirqued Glacial High Mountains



Cirqued Glacial High Mountains are mountainous areas that have obviously been sculpted by both current and past glaciation. High mountains have significant relief above a local base. These are the most prominent ridge systems in the landscape. Cirque features are semi-circular bowl like excavation

in a hanging valley or the head of a valley. An aerial view of a cirque shows a horseshoe like shape with the open end of the shoe pointing away from the steep headwall and surrounding side slopes. In the Cirqued Glacial High Mountain Landform Associations, adjacent cirques have failed to coalesce into a basin and have formed spectacular arêtes and impressive relief in the sculpted mountainsides. These areas will lack the cirque lakes and meadows found in closed cirque basin landscapes.
soils which are reliant on continual moisture.

This Landform Association has a limited spatial extent on National Forest System Lands.

Landtype Associations: Landtype Associations are formed by intersecting vegetation series or groups of vegetation series with Landform Associations.

Topography:
The following tables represent the average conditions for the Landform Association. Only lands within and adjacent to National Forest System Lands were mapped by this project. The entire EPA Level III Ecoregion is not covered by this mapping.

The percent of Landform Association (% of LfA) in bold in the table below refers to the percent of the Ecoregion represented by that Landform Association. The (% of LfA) numbers not in bold in the table below refer to the percent of each Landtype Association within the Landform Association.

Landform Association/Landtype Association	**% of LfA**	**Mean % Slope**	**Minimum Elevation (m)**	**Maximum Elevation (m)**	**Mean Elevation (m)**	**% Northerly Aspect (226° - 134°)**	**% Southerly Aspect (135° - 225°)**
Cirqued Glacial High Mountains	**1.3%**	**63**	**1188**	**1834**	**1501**	**74%**	**26%**
Cirqued Glacial High Mountains, Douglas-Fir	0.4%	63	635	1237	904	48%	52%
Cirqued Glacial High Mountains, Grand Fir	4.0%	58	929	1632	1241	68%	32%
Cirqued Glacial High Mountains, Grand Fir - Pacific Silver Fir	1.6%	60	986	1702	1358	40%	60%
Cirqued Glacial High Mountains, Grand Fir - Rock	0.5%	88	1368	2045	1742	69%	31%
Cirqued Glacial High Mountains, Grand Fir - Subalpine Fir	0.4%	62	1380	1902	1682	57%	43%
Cirqued Glacial High Mountains, Grand Fir - Western Hemlock	1.9%	51	908	1699	1283	82%	18%
Cirqued Glacial High Mountains, Ice and Snowfields	0.4%	52	1940	2429	2205	96%	4%
Cirqued Glacial High Mountains, Ice and Snowfields - Rock	1.0%	66	1391	2319	1850	80%	20%
Cirqued Glacial High Mountains, Mountain Hemlock	20.2%	52	1165	1719	1444	79%	21%
Cirqued Glacial High Mountains, Mountain Hemlock - Pacific Silver Fir	3.7%	73	1121	1727	1414	53%	47%
Cirqued Glacial High Mountains, Mountain Hemlock - Subalpine Fir	3.4%	60	1309	1962	1584	72%	28%
Cirqued Glacial High Mountains, Pacific Silver Fir	6.0%	62	959	1589	1230	80%	20%
Cirqued Glacial High Mountains, Pacific Silver Fir - Mountain Hemlock	0.4%	88	916	1551	1255	99%	1%
Cirqued Glacial High Mountains, Pacific Silver Fir - Subalpine Fir - mix	0.7%	71	1304	1975	1610	42%	58%
Cirqued Glacial High Mountains, Parkland	27.8%	72	1311	2050	1671	81%	19%
Cirqued Glacial High Mountains, Parkland - Mountain Hemlock	0.8%	72	1341	1978	1689	70%	30%
Cirqued Glacial High Mountains, Parkland - Rock	0.4%	72	1461	2051	1738	86%	14%
Cirqued Glacial High Mountains, Rock	8.6%	69	1533	2302	1904	82%	18%
Cirqued Glacial High Mountains, Rock - Parkland	0.5%	76	1441	2158	1849	73%	27%
Cirqued Glacial High Mountains, Subalpine Fir	9.4%	61	1390	1965	1672	76%	24%
Cirqued Glacial High Mountains, Subalpine Fir - Grand Fir	0.8%	75	1084	1952	1531	93%	7%
Cirqued Glacial High Mountains, Subalpine Fir - Mountain Hemlock	1.6%	65	1234	1848	1562	95%	5%
Cirqued Glacial High Mountains, Subalpine Fir - Pacific Silver Fir	0.5%	57	1274	1799	1580	98%	2%
Cirqued Glacial High Mountains, Subalpine Fir - Pacific Silver Fir - mix	0.7%	64	1183	1806	1465	79%	21%
Cirqued Glacial High Mountains, Subalpine Fir - Parkland	0.9%	74	1382	2066	1778	64%	36%
Cirqued Glacial High Mountains, Western Hemlock	0.5%	66	1122	1759	1414	18%	82%
Cirqued Glacial High Mountains, Western Hemlock - Grand Fir	0.6%	65	949	1594	1233	100%	0%
Cirqued Glacial High Mountains, Western Hemlock - Pacific Silver Fir	2.5%	61	1099	1787	1425	51%	49%

Climate:

Landtype Assocation	Mean Annual Precipitation (mm)	Mean Annual Temperature °C	AET/PET Ratio July, Aug, Sept
Cirqued Glacial High Mountains	**2132**	**4**	**0.43**
Cirqued Glacial High Mountains, Douglas-Fir	794	7	0.36
Cirqued Glacial High Mountains, Grand Fir	1328	6	0.36
Cirqued Glacial High Mountains, Grand Fir - Pacific Silver Fir	1529	5	0.38
Cirqued Glacial High Mountains, Grand Fir - Rock	1478	4	0.23
Cirqued Glacial High Mountains, Grand Fir - Subalpine Fir	1415	4	0.28
Cirqued Glacial High Mountains, Grand Fir - Western Hemlock	1492	5	0.43
Cirqued Glacial High Mountains, Ice and Snowfields	2545	0	0.39
Cirqued Glacial High Mountains, Ice and Snowfields - Rock	3407	2	0.43
Cirqued Glacial High Mountains, Mountain Hemlock	2338	4	0.48
Cirqued Glacial High Mountains, Mountain Hemlock - Pacific Silver Fir	2786	4	0.52
Cirqued Glacial High Mountains, Mountain Hemlock - Subalpine Fir	2057	4	0.41
Cirqued Glacial High Mountains, Pacific Silver Fir	2223	5	0.52
Cirqued Glacial High Mountains, Pacific Silver Fir - Mountain Hemlock	3125	5	0.53
Cirqued Glacial High Mountains, Pacific Silver Fir - Subalpine Fir - mix	2040	3	0.45
Cirqued Glacial High Mountains, Parkland	2618	3	0.43
Cirqued Glacial High Mountains, Parkland - Mountain Hemlock	2107	3	0.41
Cirqued Glacial High Mountains, Parkland - Rock	2012	3	0.41
Cirqued Glacial High Mountains, Rock	2694	2	0.38
Cirqued Glacial High Mountains, Rock - Parkland	1861	3	0.27
Cirqued Glacial High Mountains, Subalpine Fir	1524	4	0.28
Cirqued Glacial High Mountains, Subalpine Fir - Grand Fir	963	5	0.25
Cirqued Glacial High Mountains, Subalpine Fir - Mountain Hemlock	2413	4	0.41
Cirqued Glacial High Mountains, Subalpine Fir - Pacific Silver Fir	2389	3	0.49
Cirqued Glacial High Mountains, Subalpine Fir - Pacific Silver Fir - mix	1617	5	0.38
Cirqued Glacial High Mountains, Subalpine Fir - Parkland	1675	4	0.28
Cirqued Glacial High Mountains, Western Hemlock	2205	4	0.48
Cirqued Glacial High Mountains, Western Hemlock - Grand Fir	1519	5	0.45
Cirqued Glacial High Mountains, Western Hemlock - Pacific Silver Fir	1935	4	0.49

The ratio of Actual Evapotranspiration to Potential Evapotranspiration (AET/PET) is used as a broad-scale indicator of potential drought stress. We obtained modeled actual and potential evapotranspiration datasets from the Numerical Terradynamic Simulation Group at the University of Montana (http://www.ntsg.umt.edu/project/mod16) for a 30 year climate average. AET/PET ratio in the table above is based on a scale of zero to one. A value closer to 1 means the vegetation is transpiring close to

its potential. A value farther from 1means that the Actual Evapotranspiration is below potential based on this climatic zone (Ringo, et. al. 2016 in draft).