

## Eastern Cascades 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: Glacial High Mountains



**Glacial High Mountains** are areas entirely shaped by present and past glaciers. High mountains have significant relief above a local base. These are the most prominent ridge systems in the landscape. Active glaciers are still present within this map unit, as well as icefields, permanent snowfields, and widespread evidence of nivation features which include erosion of the ground beneath and at the sides

of a snow banks, mainly as a result of alternate freezing and thawing. The terrain is glacially scoured, with hanging valleys, large U-shaped valleys, with vertical to near-vertical slopes in bedrock common throughout.

A variety of soil types are present in Glacial High Mountain Landform Associations. Soils range from shallow soils to rock or exposed rock. In many locations ice has cleared out all sediment. Only in the glacial valleys do you get deep glacial soils. Shallow glacial soils are droughty even in rainy areas. What keeps them from drying out is replenishment from precipitation. These landscapes are most vulnerable to climate change. With a reduction in precipitation the glacial soils behave like ones in an arid climate.

This Landform Association has an abundant 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°)
<b>Glacial High Mountains</b>	<b>0.2%</b>	<b>47</b>	<b>1208</b>	<b>1707</b>	<b>1439</b>	<b>79%</b>	<b>21%</b>
Glacial High Mountains, Grand Fir	2.2%	44	1047	1455	1243	49%	51%
Glacial High Mountains, Grand Fir - Western Hemlock	14.8%	50	1095	1575	1286	72%	28%
Glacial High Mountains, Mountain Hemlock	44.1%	49	1242	1762	1506	81%	19%
Glacial High Mountains, Parkland	19.6%	49	1517	2066	1841	87%	13%
Glacial High Mountains, Western Hemlock - Grand Fir	12.1%	41	1092	1531	1243	87%	13%
Glacial High Mountains, Western Hemlock - Pacific Silver Fir	7.2%	44	1140	1730	1362	58%	42%

## Climate:

Landtype Association	Mean Annual Precipitation (mm)	Mean Annual Temperature °C	AET/PET Ratio July, Aug, Sept
<b>Glacial High Mountains</b>	<b>1586</b>	<b>4</b>	<b>0.37</b>
Glacial High Mountains, Grand Fir	1382	5	0.46
Glacial High Mountains, Grand Fir - Western Hemlock	1489	5	0.39
Glacial High Mountains, Mountain Hemlock	1660	4	0.36
Glacial High Mountains, Parkland	1843	3	0.32
Glacial High Mountains, Western Hemlock - Grand Fir	1428	5	0.41
Glacial High Mountains, Western Hemlock - Pacific Silver Fir	1455	5	0.33

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