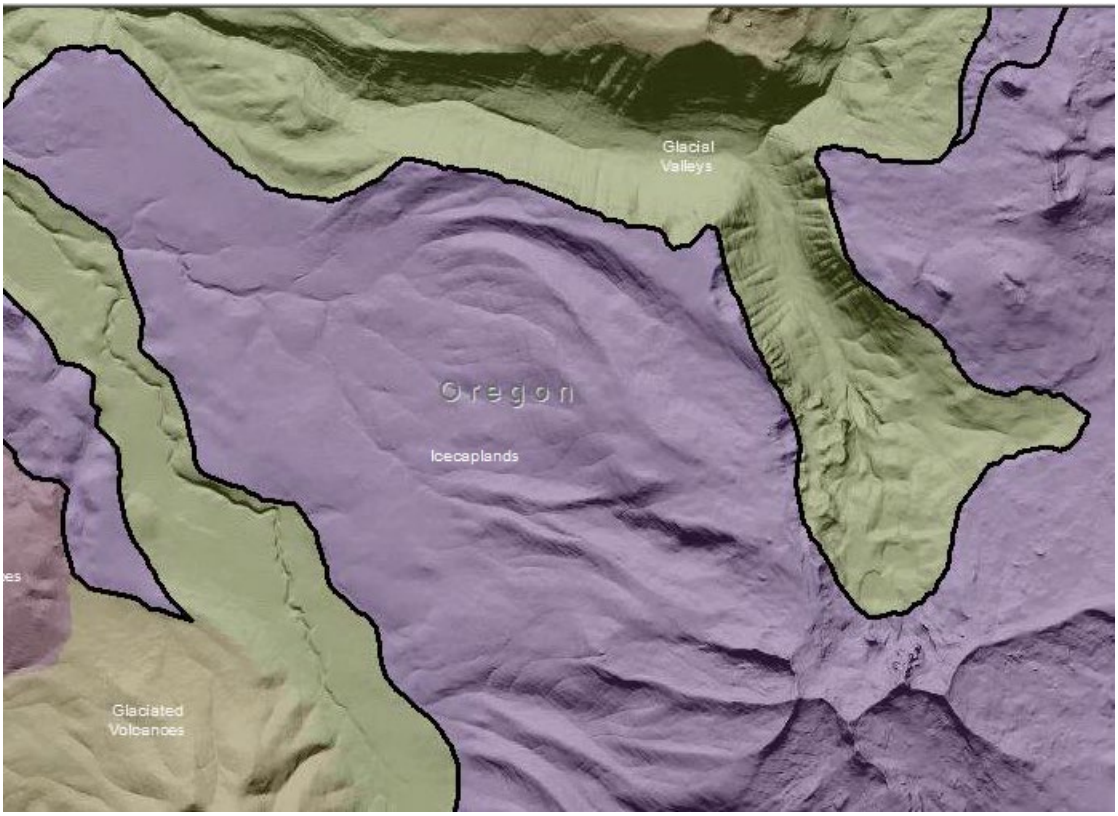
Eastern Cascades Icecaplands

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: Icecaplands



Icecaplands are a relatively new concept in mapping in the Cascades. This is terrain that has hosted or is hosting an ice cap. The terrain is a broadly scoured area and remnant glaciers may be present. The Olympic Mountains and North Cascades are examples of current icecaps. Upland areas show evidence of glaciation of an even greater magnitude than that which formed the adjoining glacial valley. Scouring

and some deposition are evident at all elevations. In ranges where volcanism was present the tops of buttes that were extruded under the ice sheet have flat topped, fan or propeller shaped forms as a result of contact with the overlaying ice sheet. The ice sheet sheared the sub-glacial magma flows leaving these distinctly shaped forms. Eskers are left behind, as the ice cap melted. The eskers appear as cobble/sediment ridges and are the remains of deposits left in sub glacial channels. As water flowed under the ice cap there were areas of aggradation. As the ice cap melted these aggraded areas have a higher and linear relief above the scoured surrounding terrain. Eskers can be found ascending ridges as well as along valley floors. Moraines are also present with successive terminal moraines common and forming curvilinear ridges that fan across the landscape for miles. Medial moraines, that indicate the flow lines of glaciers long vanished, are often visible as ridges. Seemingly stranded in the landscape moraines or ice cap margins can indicate the borders of Pleistocene lakes and delineate icecap borderlands, landforms not entirely glacier formed that existed on the glacial margins. Ice cap uplands are mountains that the icecap flowed over and sculpted.

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°)**
Icecaplands	**3.1%**	**12**	**1283**	**1492**	**1379**	**75%**	**25%**
Icecaplands, Douglas-Fir	2.8%	15	758	989	869	56%	44%
Icecaplands, Douglas-Fir - Grand Fir-White Fir	0.3%	11	648	753	699	75%	25%
Icecaplands, Douglas-Fir - Ponderosa Pine	0.6%	9	667	813	745	59%	41%
Icecaplands, Grand Fir-White Fir	63.6%	14	1209	1557	1355	75%	25%
Icecaplands, Grand Fir-White Fir - Mountain Hemlock	0.9%	12	1458	1540	1496	88%	12%
Icecaplands, Grand Fir-White Fir - Ponderosa Pine	2.4%	9	1189	1327	1253	79%	21%
Icecaplands, Grand Fir-White Fir - Shasta Red Fir	0.3%	17	1481	1827	1567	90%	10%
Icecaplands, Grand Fir-White Fir - Subalpine Fir	0.6%	8	1415	1491	1452	74%	26%
Icecaplands, Mountain Hemlock	4.2%	16	1432	1636	1551	90%	10%
Icecaplands, Mountain Hemlock - Parkland - mix	0.1%	6	1435	1496	1469	67%	33%
Icecaplands, Mountain Hemlock - Ponderosa Pine	0.2%	10	1462	1561	1490	98%	2%
Icecaplands, Mountain Hemlock - Subalpine Fir - mix	0.2%	4	1424	1478	1439	88%	12%
Icecaplands, Pacific Silver Fir	0.2%	12	1077	1187	1143	53%	47%
Icecaplands, Pacific Silver Fir - Western Hemlock	0.1%	18	1056	1208	1149	73%	27%

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°)
Icecaplands, Parkland	0.4%	7	1564	1703	1641	73%	27%
Icecaplands, Parkland - Grand Fir-White Fir - mix	0.2%	17	1595	1734	1671	49%	51%
Icecaplands, Parkland - Shasta Red Fir	0.2%	9	1553	1767	1662	39%	61%
Icecaplands, Ponderosa Pine	14.3%	7	1308	1452	1373	68%	32%
Icecaplands, Ponderosa Pine - Grand Fir-White Fir	0.8%	10	1487	1624	1550	57%	43%
Icecaplands, Ponderosa Pine - Mountain Hemlock - mix	0.4%	6	1433	1485	1457	91%	9%
Icecaplands, Ponderosa Pine - Parkland - mix	1.2%	13	1503	1757	1614	65%	35%
Icecaplands, Shasta Red Fir	4.3%	11	1577	1911	1737	63%	37%
Icecaplands, Shasta Red Fir - Grand Fir-White Fir	0.2%	14	1589	1796	1687	82%	18%
Icecaplands, Shasta Red Fir - Mountain Hemlock	0.2%	9	1696	1796	1748	85%	15%
Icecaplands, Subalpine Fir	0.1%	9	1367	1453	1403	69%	31%
Icecaplands, Subalpine Fir - Mountain Hemlock	0.2%	6	1422	1483	1443	67%	33%
Icecaplands, Subalpine Fir - Parkland	0.2%	8	1394	1507	1452	94%	6%
Icecaplands, Water	0.3%	3	1717	1764	1719	93%	7%
Icecaplands, Water - Pacific Silver Fir	0.2%	5	1431	1510	1460	89%	11%
Icecaplands, Western Hemlock	0.4%	33	791	1186	1014	79%	21%

Climate:

Landtype Assocation	Mean Annual Precipitation (mm)	Mean Annual Temperature °C	AET/PET Ratio July, Aug, Sept
Icecaplands	**912**	**6**	**0.30**
Icecaplands, Douglas-Fir	541	8	0.31
Icecaplands, Douglas-Fir - Grand Fir-White Fir	454	9	0.26
Icecaplands, Douglas-Fir - Ponderosa Pine	465	9	0.21
Icecaplands, Grand Fir-White Fir	876	7	0.32
Icecaplands, Grand Fir-White Fir - Mountain Hemlock	1033	6	0.30
Icecaplands, Grand Fir-White Fir - Ponderosa Pine	783	7	0.27
Icecaplands, Grand Fir-White Fir - Shasta Red Fir	1017	6	0.26
Icecaplands, Grand Fir-White Fir - Subalpine Fir	938	6	0.29
Icecaplands, Mountain Hemlock	1129	6	0.33
Icecaplands, Mountain Hemlock - Parkland - mix	935	6	0.23
Icecaplands, Mountain Hemlock - Ponderosa Pine	1017	6	0.24
Icecaplands, Mountain Hemlock - Subalpine Fir - mix	964	6	0.27
Icecaplands, Pacific Silver Fir	1095	7	0.58
Icecaplands, Pacific Silver Fir - Western Hemlock	1133	7	0.53
Icecaplands, Parkland	1078	6	0.20
Icecaplands, Parkland - Grand Fir-White Fir - mix	1147	6	0.24
Icecaplands, Parkland - Shasta Red Fir	1097	6	0.24
Icecaplands, Ponderosa Pine	769	6	0.24
Icecaplands, Ponderosa Pine - Grand Fir-White Fir	1022	6	0.26
Icecaplands, Ponderosa Pine - Mountain Hemlock - mix	1050	6	0.25
Icecaplands, Ponderosa Pine - Parkland - mix	1034	6	0.22
Icecaplands, Shasta Red Fir	1211	6	0.22
Icecaplands, Shasta Red Fir - Grand Fir-White Fir	1104	6	0.21
Icecaplands, Shasta Red Fir - Mountain Hemlock	1265	6	0.21
Icecaplands, Subalpine Fir	837	6	0.35
Icecaplands, Subalpine Fir - Mountain Hemlock	890	6	0.38
Icecaplands, Subalpine Fir - Parkland	863	6	0.33
Icecaplands, Water	1334	6	0.18
Icecaplands, Water - Pacific Silver Fir	1051	6	0.34
Icecaplands, Western Hemlock	952	7	0.54

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).