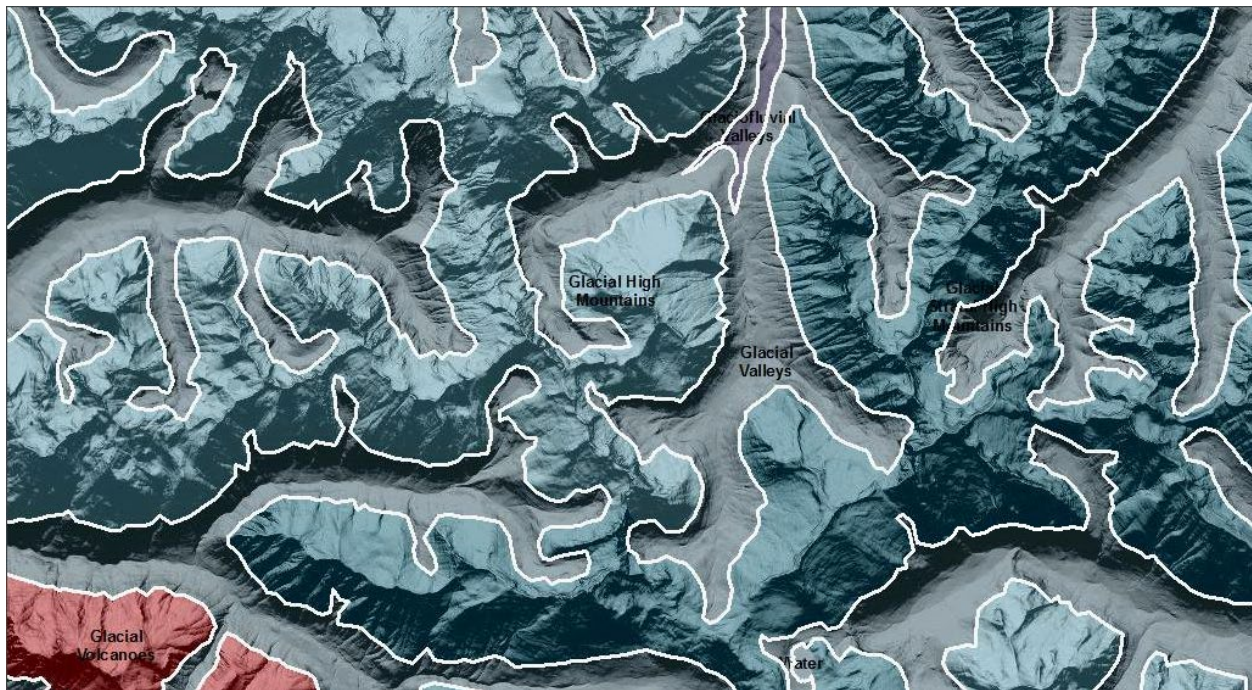


North Cascades Glacial Valleys

Valley [Landscape Term] (a) Any low-lying land bordered by higher ground; esp. an elongate, relatively large, gently sloping depression of the Earth's surface, commonly situated between two mountains or between ranges of hills or mountains, and often containing a stream with an outlet. It is usually developed by stream erosion, but may be formed by faulting. (b) A broad area of generally flat land extending inland for a considerable distance, drained or watered by a large river and its tributaries; a river basin. (Bates and Jackson, 1995)

Landform Association:

Glacial Valleys



Glacial Valleys are the U-shaped, ice-covered valley segments in glacial and glaciated areas. They include both the glacial valley bottom and sideslopes of the glacial valley wall. Often the landform is too narrow at this scale of mapping to differentiate the bottom as in Glacial Valley Bottoms from the wall sections themselves. The sideslopes accumulate the basal and lateral till of the valley glacier. The area experienced immediate post glacial redistribution of valley side till through colluvial deposition, debris flows, and sheet flow with deposition onto the valley floor. Many areas of the valley walls are exposed to bedrock as a result. There are pockets of lateral moraines with fluvial deposits between them. Seeps and springs emerge in the colluvial material and associated with till deposits.

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°)
Glacial Valleys	24.0%	49	912	1589	1221	78%	22%
Glacial Valleys, Developed	0.1%	8	328	496	378	46%	54%
Glacial Valleys, Developed - Ponderosa Pine	0.0%	22	355	514	407	88%	12%
Glacial Valleys, Douglas-Fir	9.3%	58	669	1524	1003	71%	29%
Glacial Valleys, Douglas-Fir - Pacific Silver Fir	0.1%	82	884	1727	1278	64%	36%
Glacial Valleys, Douglas-Fir - Ponderosa Pine	0.1%	56	568	1174	869	97%	3%
Glacial Valleys, Douglas-Fir - Subalpine Fir	0.1%	57	818	1633	1247	66%	34%
Glacial Valleys, Douglas-Fir - Western Hemlock	0.3%	64	813	1660	1112	46%	54%
Glacial Valleys, Grand Fir	3.7%	46	653	1396	935	74%	26%
Glacial Valleys, Grand Fir - Douglas-Fir	0.2%	65	488	1561	921	71%	29%
Glacial Valleys, Grand Fir - Subalpine Fir	0.0%	89	336	1921	1120	88%	12%
Glacial Valleys, Grand Fir - Western Hemlock	0.1%	47	751	1146	886	77%	23%
Glacial Valleys, Ice and Snowfields	0.0%	36	1559	2143	1906	95%	5%
Glacial Valleys, Ice and Snowfields - Rock	0.0%	45	1366	2103	1759	90%	10%
Glacial Valleys, Mountain Hemlock	9.6%	46	977	1526	1237	82%	18%
Glacial Valleys, Mountain Hemlock - Grand Fir	0.1%	46	1171	1968	1561	55%	45%
Glacial Valleys, Mountain Hemlock - Ice and Snowfields	0.1%	52	934	1964	1344	92%	8%
Glacial Valleys, Mountain Hemlock - Pacific Silver Fir	2.1%	50	1043	1770	1381	79%	21%
Glacial Valleys, Mountain Hemlock - Pacific Silver Fir - mix	0.0%	47	936	1933	1558	99%	1%
Glacial Valleys, Mountain Hemlock - Parkland	2.1%	57	1061	1852	1439	78%	22%
Glacial Valleys, Mountain Hemlock - Parkland - mix	0.0%	23	1547	1985	1760	80%	20%
Glacial Valleys, Mountain Hemlock - Rock	0.2%	58	984	1745	1330	92%	8%
Glacial Valleys, Mountain Hemlock - Subalpine Fir	0.7%	46	1156	1901	1524	86%	14%
Glacial Valleys, Mountain Hemlock - Water	0.0%	115	627	1677	992	97%	3%
Glacial Valleys, Mountain Hemlock - Western Hemlock	0.1%	58	938	1811	1375	75%	25%
Glacial Valleys, Pacific Silver Fir	29.5%	49	569	1362	922	78%	22%
Glacial Valleys, Pacific Silver Fir - Douglas-Fir	0.0%	59	545	1711	1014	76%	24%
Glacial Valleys, Pacific Silver Fir - Grand Fir	0.3%	35	954	1511	1176	70%	30%
Glacial Valleys, Pacific Silver Fir - Mountain Hemlock	1.6%	53	642	1448	1029	81%	19%
Glacial Valleys, Pacific Silver Fir - Parkland	0.0%	67	1344	2115	1718	77%	23%
Glacial Valleys, Pacific Silver Fir - Rock	0.0%	81	1235	2015	1596	100%	0%
Glacial Valleys, Pacific Silver Fir - Subalpine Fir	0.4%	51	953	1691	1335	77%	23%
Glacial Valleys, Pacific Silver Fir - Western Hemlock	2.6%	53	702	1485	1069	72%	28%
Glacial Valleys, Parkland	2.8%	41	1619	2061	1823	82%	18%
Glacial Valleys, Parkland - Douglas-Fir	0.1%	49	1174	2067	1711	56%	44%
Glacial Valleys, Parkland - Douglas-Fir - mix	0.0%	52	1350	2009	1692	63%	37%
Glacial Valleys, Parkland - Mountain Hemlock	0.4%	50	1242	1877	1552	79%	21%
Glacial Valleys, Parkland - Pacific Silver Fir	0.1%	53	1493	2062	1756	61%	39%
Glacial Valleys, Parkland - Rock	0.3%	53	1351	1999	1643	86%	14%
Glacial Valleys, Parkland - Subalpine Fir	0.2%	52	1393	2061	1734	86%	14%
Glacial Valleys, Ponderosa Pine	0.3%	43	395	859	603	71%	29%
Glacial Valleys, Ponderosa Pine - Douglas-Fir	0.2%	51	440	865	595	54%	46%

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°)
Glacial Valleys, Ponderosa Pine - Grand Fir	0.0%	37	478	686	532	90%	10%
Glacial Valleys, Ponderosa Pine - Shrub-Steppe	0.2%	59	336	896	490	79%	21%
Glacial Valleys, Rock	0.3%	54	1514	2109	1798	90%	10%
Glacial Valleys, Rock - Ice and Snowfields	0.0%	54	1415	2129	1738	97%	3%
Glacial Valleys, Rock - Mountain Hemlock	0.1%	69	1038	1951	1515	89%	11%
Glacial Valleys, Rock - Pacific Silver Fir	0.0%	73	1271	2186	1698	100%	0%
Glacial Valleys, Rock - Parkland	0.1%	55	1324	1989	1634	83%	17%
Glacial Valleys, Shrub-Steppe	0.2%	53	336	811	515	52%	48%
Glacial Valleys, Shrub-Steppe - Ponderosa Pine	0.1%	59	336	884	502	63%	37%
Glacial Valleys, Subalpine Fir	14.5%	45	1182	2003	1623	83%	17%
Glacial Valleys, Subalpine Fir - Douglas-Fir	0.1%	54	1187	1664	1410	83%	17%
Glacial Valleys, Subalpine Fir - Grand Fir	0.1%	52	1209	1876	1537	51%	49%
Glacial Valleys, Subalpine Fir - Mountain Hemlock	0.1%	45	1341	1927	1631	72%	28%
Glacial Valleys, Subalpine Fir - Mountain Hemlock - mix	0.0%	57	1197	2125	1697	99%	1%
Glacial Valleys, Subalpine Fir - Pacific Silver Fir	0.1%	48	1116	1767	1484	82%	18%
Glacial Valleys, Subalpine Fir - Parkland	0.7%	47	1331	2023	1699	70%	30%
Glacial Valleys, Subalpine Fir - Rock	0.1%	56	1275	2029	1679	98%	2%
Glacial Valleys, Subalpine Fir - Western Hemlock	0.1%	52	972	1699	1374	86%	14%
Glacial Valleys, Water	0.0%	8	443	540	448	82%	18%
Glacial Valleys, Western Hemlock	13.2%	44	483	1066	689	64%	36%
Glacial Valleys, Western Hemlock - Douglas-Fir	0.5%	62	738	1425	997	77%	23%
Glacial Valleys, Western Hemlock - Grand Fir	0.3%	52	683	1310	895	74%	26%
Glacial Valleys, Western Hemlock - Mountain Hemlock	0.1%	53	815	1586	1139	79%	21%
Glacial Valleys, Western Hemlock - Mountain Hemlock - mix	0.1%	60	848	1938	1445	77%	23%
Glacial Valleys, Western Hemlock - Pacific Silver Fir	0.5%	54	733	1321	956	76%	24%
Glacial Valleys, Western Hemlock - Subalpine Fir - mix	0.1%	56	1024	1975	1410	69%	31%

Climate:

Landform Association/Landtype Association	Mean Annual Precipitation (mm)	Mean Annual Temperature °C	AET/PET Ratio July, Aug, Sept
Glacial Valleys	2047	5	0.44
Glacial Valleys, Developed	572	10	0.33
Glacial Valleys, Developed - Ponderosa Pine	644	9	0.30
Glacial Valleys, Douglas-Fir	808	6	0.33
Glacial Valleys, Douglas-Fir - Pacific Silver Fir	1379	4	0.45
Glacial Valleys, Douglas-Fir - Ponderosa Pine	369	7	0.19
Glacial Valleys, Douglas-Fir - Subalpine Fir	1039	5	0.38
Glacial Valleys, Douglas-Fir - Western Hemlock	1489	5	0.50
Glacial Valleys, Grand Fir	1069	7	0.41
Glacial Valleys, Grand Fir - Douglas-Fir	1045	7	0.37
Glacial Valleys, Grand Fir - Subalpine Fir	686	6	0.26
Glacial Valleys, Grand Fir - Western Hemlock	1236	6	0.52
Glacial Valleys, Ice and Snowfields	4509	2	0.45
Glacial Valleys, Ice and Snowfields - Rock	2871	3	0.42
Glacial Valleys, Mountain Hemlock	2598	5	0.48
Glacial Valleys, Mountain Hemlock - Grand Fir	1835	3	0.37

Landform Association/Landtype Association	Mean Annual Precipitation (mm)	Mean Annual Temperature °C	AET/PET Ratio July, Aug, Sept
Glacial Valleys, Mountain Hemlock - Ice and Snowfields	3295	5	0.44
Glacial Valleys, Mountain Hemlock - Pacific Silver Fir	1943	4	0.45
Glacial Valleys, Mountain Hemlock - Pacific Silver Fir - mix	1335	3	0.34
Glacial Valleys, Mountain Hemlock - Parkland	2254	4	0.43
Glacial Valleys, Mountain Hemlock - Parkland - mix	1287	2	0.34
Glacial Valleys, Mountain Hemlock - Rock	2723	4	0.42
Glacial Valleys, Mountain Hemlock - Subalpine Fir	1447	3	0.40
Glacial Valleys, Mountain Hemlock - Water	3775	6	0.49
Glacial Valleys, Mountain Hemlock - Western Hemlock	1641	4	0.45
Glacial Valleys, Pacific Silver Fir	2550	6	0.53
Glacial Valleys, Pacific Silver Fir - Douglas-Fir	1676	6	0.48
Glacial Valleys, Pacific Silver Fir - Grand Fir	1215	6	0.41
Glacial Valleys, Pacific Silver Fir - Mountain Hemlock	2470	6	0.50
Glacial Valleys, Pacific Silver Fir - Parkland	1356	3	0.34
Glacial Valleys, Pacific Silver Fir - Rock	1927	3	0.30
Glacial Valleys, Pacific Silver Fir - Subalpine Fir	1438	4	0.40
Glacial Valleys, Pacific Silver Fir - Western Hemlock	1803	6	0.48
Glacial Valleys, Parkland	1998	2	0.32
Glacial Valleys, Parkland - Douglas-Fir	1556	3	0.33
Glacial Valleys, Parkland - Douglas-Fir - mix	1369	2	0.40
Glacial Valleys, Parkland - Mountain Hemlock	2420	3	0.37
Glacial Valleys, Parkland - Pacific Silver Fir	1774	2	0.32
Glacial Valleys, Parkland - Rock	2688	3	0.38
Glacial Valleys, Parkland - Subalpine Fir	1502	3	0.34
Glacial Valleys, Ponderosa Pine	451	8	0.19
Glacial Valleys, Ponderosa Pine - Douglas-Fir	681	8	0.30
Glacial Valleys, Ponderosa Pine - Grand Fir	423	8	0.26
Glacial Valleys, Ponderosa Pine - Shrub-Steppe	369	9	0.20
Glacial Valleys, Rock	2731	2	0.34
Glacial Valleys, Rock - Ice and Snowfields	2309	3	0.37
Glacial Valleys, Rock - Mountain Hemlock	2252	3	0.35
Glacial Valleys, Rock - Pacific Silver Fir	2024	3	0.31
Glacial Valleys, Rock - Parkland	2983	3	0.39
Glacial Valleys, Shrub-Steppe	321	9	0.11
Glacial Valleys, Shrub-Steppe - Ponderosa Pine	375	9	0.15
Glacial Valleys, Subalpine Fir	1165	3	0.30
Glacial Valleys, Subalpine Fir - Douglas-Fir	985	4	0.31
Glacial Valleys, Subalpine Fir - Grand Fir	1204	4	0.29
Glacial Valleys, Subalpine Fir - Mountain Hemlock	1353	3	0.36
Glacial Valleys, Subalpine Fir - Mountain Hemlock - mix	1604	3	0.29
Glacial Valleys, Subalpine Fir - Pacific Silver Fir	1424	4	0.36
Glacial Valleys, Subalpine Fir - Parkland	1472	3	0.37
Glacial Valleys, Subalpine Fir - Rock	1474	3	0.21
Glacial Valleys, Subalpine Fir - Western Hemlock	1508	4	0.34
Glacial Valleys, Water	3090	9	0.49
Glacial Valleys, Western Hemlock	2245	7	0.55
Glacial Valleys, Western Hemlock - Douglas-Fir	1380	6	0.46
Glacial Valleys, Western Hemlock - Grand Fir	1140	7	0.47

Landform Association/Landtype Association	Mean Annual Precipitation (mm)	Mean Annual Temperature °C	AET/PET Ratio July, Aug, Sept
Glacial Valleys, Western Hemlock - Mountain Hemlock	1404	5	0.46
Glacial Valleys, Western Hemlock - Mountain Hemlock - mix	1552	4	0.47
Glacial Valleys, Western Hemlock - Pacific Silver Fir	1996	6	0.50
Glacial Valleys, Western Hemlock - Subalpine Fir - mix	1323	4	0.36

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).