**PLATEAU LANDFORMS ASSOCIATIONS**

**Plateaus** in the Pacific Northwest are predominantly underlain by stacked flows of the Columbia River Basalts and form extensive elevated plains bounded on one or more sides by steep slopes hundreds of feet above adjoining areas. Plateaus are differentiated from each other by the most-evident surficial processes of alteration.

**Glacial Processes**

***Glacial***

**Glacial Plateaus** are plateaus with obvious ice-carved landforms including cirques and U-shaped valleys. Plateaus adjacent to Mt. Rainier were eroded by alpine glaciers. Thin to no soil is present where the plateau is scoured and deeper soils develop in localizes area of till and meltwater deposition. The plateau will be scoured in places with deeper soils captured in areas of deposition. Undulating topography occurs on the plateau surface. High precipitation enhances weathering and creates an environment with high forest productivity. Steep bedrock scoured glacial valley walls occur with colluvial material at the base. Sorted sediments can be found across the valley floor.

**Icesheet Plateaus** are old flood basalt plateaus that were once covered by continental icesheet. The Okanogan lobe of the Cordilleran Icesheet covered this landscape of northeastern Washington. An ice sheet is a mass of glacial ice extending more than 50,000 square kilometers (20,000 square miles). It moves in multiple directions from a central deep accumulation zone, thicker in the central portion and thinning toward the edges where these plateaus occur. Areas of glacial till and meltwater deposits in among scoured areas would be left in the path of the icesheet moving across this plateau. Deep sediments can be found in lower landscape positions within and adjacent to this map unit. Streams commonly go underground in this reworked glacial sediment.

***Glaciated***

**Glaciated Plateaus** are Plateaus with masked glaciation or nivation features from past alpine glacial activity moving across an existing plateau landscape. Nivation features, including shallow bowls and arcuate headwalls were created by erosion of the ground beneath and around snowbanks and permanent ice fields mainly as a result of freeze-thaw and ice plucking. Much of the signature of glaciation is masked as a result of erosional and weathering processes over time.

**Mass Wasting Processes**

**Collapsed Plateaus** consists of plateaus that are dominated by landslides, with hummocky poorly-drained, chaotic fallen bedrock blocks that divert drainages and rivers. Landslide areas can cover many miles and may be from the pre-historic past or a recent and current development. Water routing through this landscape may be irregular due to recent and on-going slope failure with its accompanying surface and subsurface drainage diversions and impoundments. Sediment recruitment by streams is significant along the margins of collapsed plateaus. Sediment and water storage (such as a lake, meadow and or plain - current or historic) is locally significant upstream of collapsed landslide toes. Because of irregular slopes and varied surface water availability, this LfA has a most diverse upland habitat. The slide areas can hold deep soils, retain moisture and provide micro-climates that offer a variety of excellent resources for numerous floral and faunal communities.

**Incised Plateaus:** The Columbia River and associated basalt flows constitute one of the largest flood basalt flows in the world. The basalt flows emanated from a series of fractures in the earth surface. Initially they created a broad, nearly level plateau up to 8000 to 9000 feet thick that covered an area of 77,000 square miles across eastern Oregon and southwest Washington (Orr and Orr, 2012). Much of the plateau is without a perennial source of water.

Incised refers to landscapes and landforms that retain their outlines and the majority of their mass but are experiencing and initial alteration of form due to weathering. Depending on stage of erosion, plateaus will manifest varying degrees of incision. Initially water is transmitted directly below ground through a series of fractures in the flow. As the original basalt flows weather, surface runoff increases. Fluvial erosion processes intiate incision and ephemeral stream channel formation. With increased weathering and erosion, runoff of snowment and precipitation dominates and deep incisions occur at weak points in the basalt flows. The plateau becomes highly incised, eventually giving way to deep incision of canyons which headcut back into the plateaus over time.

Figure XX: Noller depiction of landform relationships based on degree of weathering and erosion and runoff from the landscape.

**Verrucated Plateaus** have a hummocky, warty morphology, including common hillocks and poorly organized to tortuous drainages, but cannot be definitely ascribed to mass failure as the dominant surface process. Origins for this type of LfA include ancient landslides that have been eroded, such as exhumed deep-marine landslides incorporated in a bedrock formation, or exhumed ancient volcanic flows in bedrock strata. As such, the hummocky terrain is associated with eroded portions of the landscape. Verrucated plateaus include portions of incised or angulate plateaus where the underlying strata (typically sedimentary formations) have been exposed but not reactivated towards failure. In this map unit, drainages are poorly integrated, leading to variable routing of surface water through this type of landscape. Seeps and springs occur as a result. Because of irregular slopes and aspects, as well as varied surface water availability, this LfA has a diverse upland habit.

**Tectonic Processes**

**Angulate Plateaus** are characterized by having a strong prominent system of drainages at other than at right angles due to rock structure, including joints and faults. Subsidiary channel incision of these plateaus proceeds along these structural weaknesses. Water routing along drainages follows dominantly straight reaches which may lead to flashy discharges during storms. Unless overlain by loess, these surfaces are mantled by thin, residual soils.

**Faulted Incised Plateaus** are narrow elongate upland plains cut by parallel and sub-parallel faults. Typically these are normal faults with much more vertical than lateral displacement. The faulting has created positive (uplands) and negative (drainages) patterns with repeating topographic elements. These plateaus are characterized by numerous faults over a broad area up to several kilometers in extent. Many of these faults show evidence of movement during the recent geologic past.

The drainages in the Faulted Incised Plateaus are captured and redirected by displacement of the fault blocks. The rearrangement and redirection of precipitation runoff by the fault blocks gives a zig-zag appearance to catchment channels. The faults are zones of weakness and set up water flows along these zones. Sediment is impounded by fault scarps, in closed depressions, and at locations with lower slope angle. In these pockets of sediment accumulation there is increased soil development.

The slopes in this landform are a mix of steep (tectonic) and not so steep (erosion processes) slope. Bedrock slopes within this map unit occur more as a result of tectonic activity than erosion. The tectonic created slopes are steeper than the angle of repose of slopes created by erosion. These slopes have developed little if any soil mantle. There are valleys with flows that have been diverted or captured flow by other drainages. These captured or diverted drainages are essentially “hanging valleys.” These hanging valleys are dominated by sheet flow at a reduced rate and sediment transport is reduced.

**Volcanic Processes**

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