

# APPENDICES



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# APPENDIX A: Glossary of Habitat Terms and Concepts

## Off-channel habitat

Off-channel habitat is any relatively calm portion of a stream outside the main flow of the stream. These habitat types include side-channels, sloughs, dead-end channels, wetlands, oxbows, and smaller watercourses and lakes in the floodplain. These habitats are extremely important to juvenile salmonids as overwintering rearing habitat and as refuge areas during high flow events.

## Braided channel/side channel

Natural river and stream channels have a tendency to form multiple channels, like an unraveled piece of multi-stranded rope. Channel braiding generally occurs when there is a reduction in stream gradient, which leads to gravel deposition, or a widening of the floodplain. In a braid or rope, the strands that are woven together are generally uniform in length and thickness. In river systems, the multiple channels are invariably different widths, depths, and lengths. The variety of sizes results in a wide range of habitat conditions over the full range of flow conditions in the river or stream. Over the past hundred years, humans have worked to consolidate channels in an effort to increase the amount of land available for economic uses. The result has been a reduction of habitat area for aquatic life and the elimination of important habitat types, such as refuge areas during flood events and rearing areas for juvenile salmon.

## Channel migration

River and stream channels are not fixed in a single location over time. Channels shift gradually, as a result of bank erosion, or dramatically during major flood events. The process of change can have temporary, local impacts, but the system as a whole is adapted to the change and relies upon it for nutrients and structural inputs. Large woody debris and coarse sediment are two examples of critical inputs that result from channel migration. In a cultural system that is built upon land ownership, loss of land to the force of flowing water is countered with bank protection and bank armoring. While bank protection successfully eliminates the local impacts, the system loses an important enriching process. If repeated systematically across the landscape, the system could be at risk of fundamental alteration in complexity and productivity.

## Edge habitat

Edge habitat is the place where two distinct habitat areas meet. In a river or stream setting, the habitat types that meet one another are the water and land. Stream banks and streambeds are very productive areas, particularly if these areas are natural and untidy. A natural stream bank will rarely exhibit a smooth or straight line. The irregularities in the structure of the channel create eddies and holes that serve as pockets of habitat, particularly for juvenile fish. Overhanging branches, undercut banks, and submerged rootwads are some examples of edge habitats that benefit fish by providing cover and a source of food (fish feed on the insects that like to use these structures, too). Banks that have been armored have been shown to be used less than natural banks.

## Forest retention

Forests are a critical part of the Pacific Northwest ecosystem. The lush forests of the Olympics and Western Cascades have had dramatic influences upon the landscape. Their extensive root systems knit together the unconsolidated soils common to the region. The year-round canopy afforded by fir, cedar, hemlock, and Sitka spruce alters runoff patterns and creates shade conditions that determine the composition of understory foliage. The enormous size of mature Pacific Northwest conifers also makes them an important structural component of the ecosystem, long after their life span. Snags and fallen logs provide much of the structure required by wildlife. Even rivers are affected by the presence of the great trees (see Large Woody Debris). Loss of forest cover and change in the age composition of regional forests can have profound effects on the ecosystem. Many of our recommendations for habitat protection involve steps to increase forest retention to recapture the ecological functions provided by mature forests.

## Large woody debris

Large Woody Debris is the term used for mature trees that fall into streams and rivers. Due to the Pacific Northwest's geological history, this region's rivers tend to interact with glacial outwash soils, which contain few large particles. As a result, streambeds have little resistance to erosion. In addition, the streambed rarely contains geologically derived elements, such as boulders or bedrock formations,

that substantially influence channel-shaping forces. The Pacific Northwest substitute has been large woody debris. The enormous trees that once dominated the landscape played a critical role for streams even after they died and fell to the ground. Logs in the channel stabilized streambeds by slowing the flow and absorbing or transferring energy. Logs also encourage the formation of pools through scour. A series of logs jammed in a large river can precipitate a shift in the channel or the formation of a side channel. The result is generally the development of more complex habitat that benefits salmonids.

### **Levee setback**

A levee setback involves moving the flood reduction structure away from the banks of the river. The greater the distance between the levee and the river, the closer floodplain and riparian functions will be to undisturbed conditions. This option is preferable where critical infrastructure exists in the floodplain, making levee removals impractical.

### **Pools and riffles**

Rivers and streams can be categorized into habitat units. Some stretches of a stream are fast moving and the surface of the water is turbulent. Other sections move slowly and have a smooth appearance. Pools are sections that move slowly and are considerably deeper than the average depth of the river/stream. Pools are important habitat for adult and juvenile fish. The slow water allows the fish to rest and the depth provides protection from predators. Riffles are fast-moving sections of river or stream which exhibit a moderate level of surface disturbance. Riffles are often associated with gravel or cobble streambeds and often are good spawning areas. Many streams and rivers naturally adopt an alternating pool-riffle character. The meandering shape of the channel organizes the energy of the flow such that pools form at the bends and riffles form in the sections between the bends. This configuration provides a good ratio of habitat types for fish use. Much of our focus in river management over the past century has been to straighten channels, thereby altering the distribution of energy and eliminating much of the pool habitat.

### **Public Benefit Rating System**

The Public Benefit Rating System is a method of valuing private property to assess its tax liability. In most cases, property tax is assessed assuming the most economically productive use of the parcel given its location and zoning classification. Property owners who are willing to sign a contract that commits them to voluntarily limit the use of their

land to certain categories that provide a public benefit, such as timber or open space, receive a discount on the tax rate levied against that land. Land that provides extra buffer area to streams, rivers, and wetlands are eligible for enrollment in the Public Benefit Rating System.

### **Riparian functions**

Riparian and floodplain areas are the critical interface between terrestrial and aquatic ecosystems, serving to filter, retain, and process materials in transit from uplands to streams. Riparian vegetation plays a major role in providing shade to streams and overhanging cover used by salmonids. Streamside vegetation stabilizes streambanks by providing root mass to maintain bank integrity, by producing hydraulic roughness to slow water velocities, and by promoting bank building through retention of sediments. Riparian vegetation also provides much of the organic litter required to support biotic activity within the streams and provides habitat for insects on which fish, birds, and mammals feed. These riparian areas also provide much of the large woody debris needed to create physical habitat structure (develop pool-riffle characteristics, retain streambed gravel and organic litter, provide substrate for aquatic invertebrates), moderate flood disturbances, and provide refugia for organisms during floods. In addition to the aquatic functions that riparian areas perform, they typically provide habitat and create unique microclimates important to a majority of the wildlife species occupying the watershed. (from *An Ecosystem Approach to Salmonid Conservation*, Spence, et al., 1996, p. 3)

### **River/floodplain interactions**

Flooding occurs when a river exceeds the capacity of its channel. Rivers tend to form a channel capable of containing roughly a 2-year event (a flow that has a 50% probability of occurring in a given year). When a river remains within its channel, most of the energy of the flow acts upon the channel itself. When the river floods, some of the energy is dissipated upon the floodplain, which lessens the impact on the channel itself. If the river/floodplain interactions are altered through the construction of levees and revetments, the river channel is exposed to a different set of energy dynamics than it historically experienced. The change in channel forming processes results in a change in the character of the river and the habitat within it. Examples of alterations include downcutting of the stream bed, a drop in water table elevation, loss in floodplain rearing habitat, and a loss of instream habitat diversity.