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# The Importance of Healthy Floodplains to Pacific Salmon & Steelhead

## What does the best available science tell us about floodplains and their relationship to salmon?

### Connectivity

When rivers are connected to their floodplains, channels are able to migrate naturally. This process creates side channels, back-water sloughs, and other off-channel habitats that are important refuge for salmon. During high flow events, water is distributed across floodplain habitats—dissipating hydraulic energy and increasing the exchange of nutrients and organic material between aquatic and riparian habitats.

### Rearing & Spawning Habitat

Coho salmon in particular rely heavily on floodplain habitat for rearing. Juvenile coho show strong preference for pools and woody debris cover in the summer months and for side-channel and pond habitats in the winter months. But other salmon species also depend on functioning floodplain habitat. Chum salmon, for example, rely primarily on floodplain areas for spawning. Chinook salmon juveniles use the floodplain for rearing.

### How do floodplains contribute to healthy salmon runs?

Floodplains are vital to the health of Pacific salmon and steelhead because they provide important habitat during the freshwater phase of the salmon life cycle.

Healthy floodplains contribute to the biological processes necessary for salmon survival in many ways, including:

- Allowing the river to naturally migrate and form a diversity of habitat types critical to the survival of different salmon species at various life stages;
- Facilitating exchange of nutrients and organic material between land and water, thus increasing habitat complexity via food subsidies and large woody debris;
- Providing off-channel areas with a high abundance of terrestrial and aquatic food sources;
- Creating shallow habitat with cover that allows small salmon to hide from larger predators;
- Improving riparian habitat for species such as aquatic insects, beaver, and bear that are important elements of salmon ecology;
- Providing slow-water refuge for juvenile salmon to avoid high river flow volume, which allows salmon to rear as long as necessary and conserve energy for their entry to the ocean;
- Providing coarse beds of sediment through which water flows, which filters excess nutrients and other chemicals to maintain high water quality; and
- Providing an expanded area for depositing and storing excess sediment, particularly fine sediment. This reduces the effects of turbidity on fish.

Additionally, the water storage and recharge function of floodplains ensures a source of cold water in summer months and warmer water during winter months. Water seeps into the groundwater table during floods, recharging wetlands, off-channel areas, and shallow aquifers. In turn, these areas release water to the stream during the summer months. Without this recharge, flows are typically lower and water is warmer. Finally, the groundwater storage/recharge process reduces the likelihood of high-energy flood events that can scour away salmon nests during the winter months.

## How does development impact floodplains?

Large portions of floodplains no longer function in their natural form because they have been restructured to meet urban and agricultural needs. Development can affect floodplains by disconnecting them from the river channels and by destroying natural riparian upland and wetland vegetation.

There is a direct relationship between loss of floodplain function and trends in declining salmon runs. In particular, altering the natural processes that allow habitat to form and recover from disturbances such as floods, landslides, and droughts has the following detrimental effects on salmon habitat:

- Loss of side channels, sloughs, and other in-channel and off-channel rearing and refuge habitats;
- Increased flow velocity during flood events;
- Increased severity and frequency of peak and low flows;
- Reduced subsurface flows and groundwater contributions to the river;
- Simplified habitat complexity due to loss of large woody debris and terrestrial food sources; and
- Reduced shade that helps to regulate water temperatures.

When viewing these effects on a regional scale, the relationship between floodplains and salmon production is pronounced. In Puget Sound, roughly 73 percent of the wetland vegetation in major river deltas has been lost in the last 100 years. Similar effects are occurring in the Willamette Valley, where the Willamette River has been channelized and stripped of large wood. Gregory et al. (2002) calculated that between 1895 and 1995 the total mainstem Willamette River channel area decreased from 41,000 to 23,000 acres. In the reach between Eugene and Albany alone, the river lost 45 percent of its channel length, along with 74 percent of alcoves and 80 percent of island areas. This loss of functioning habitat due to floodplain disconnection directly correlates to the declining status of salmon runs. However, it is one factor among many. Throughout the Northwest, the loss of functioning habitat in conjunction with dam operations, harvest practices, and hatchery operations have all contributed to the listing of Pacific salmon under the Endangered Species Act.

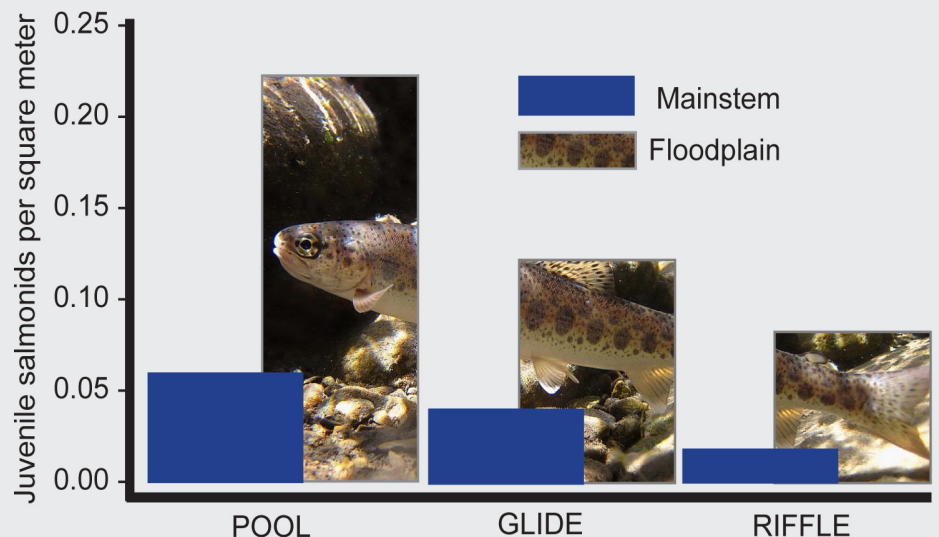
## How do functioning floodplains contribute to ecosystem health?

Currently, there are 19 species of salmon and steelhead protected under the Endangered Species Act in the Northwest. Functioning floodplains allow for effective habitat formation—providing refuge to salmon, increasing their energy reserves, and protecting the reproductive processes necessary for salmon recovery. To achieve recovery objectives, like adequate population distribution and genetic diversity, it is important to both preserve and restore those floodplains used by salmon.

Floodplains not only serve an important role in the freshwater phase of the salmon life cycle, but they also contribute to the health of the larger ecosystem. Salmon, for instance, is the primary food source for numerous other species. Nutrients released from the bodies of adult salmon after spawning also fertilize the aquatic and riparian environment, thus maintaining biological productivity for the next generation of salmon.

## Functioning floodplains are part of healthy ecosystems

During high water events, floodplains provide a vast low water velocity area where suspended particles fall out of the water column and are deposited. These materials are a result of higher water velocity upstream which scours the channels, cleaning the gravels and cobbles, and reducing their width:depth ratio. The resulting clean gravel and cobbles are a better environment to aerate salmon eggs and provide cover for juveniles and invertebrate forage species. The deeper, narrower stream is an ideal habitat for growing salmon and reduces solar heating. Not coincidentally, this process also contributes to excellent soil quality on the floodplains. Those superb soils support complex vegetation development.



**In the lower Elwha River, juvenile salmon used floodplain habitat (pools, glides and riffles) more than mainstem habitats to grow.<sup>1</sup>**

<sup>1</sup>Pess, G. R., M. L. McHenry, T. J. Beechie, and J. Davies. 2008. Biological impacts of the Elwha River dams and potential salmonid responses to dam removal. Northwest Science 82 (Special Issue):72-90. Photo: John McMillan



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