Approaches to River Restoration and Salmonid Habitat Improvement in the Pacific Northwest

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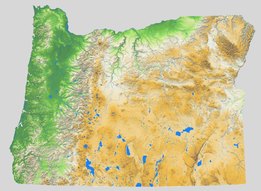


Abstract

For years, Pacific Northwest salmonids have faced endangerment and have had their population size threatened. As a result, millions of dollars have been invested annually to restore their natural habitat, however completed projects have had little evaluation on effectiveness of treatment. Along with varied results from restoration techniques, there is a dispute within the scientific community over success and effectiveness. Consequently stream rehabilitation experts have created a hierarchical strategy for site specific restoration assessment, which include: (1) assessment of watershed processes, (2) protecting already existing high-quality habitats, and (3) understanding effectiveness of current techniques for habitat rehabilitation. After assessing the habitat site, there are a number of options. First and foremost, the most important task is protecting current high-quality habitats; then reopening or repairing high quality habitats that were cut-off through means of artificial blockages (roads, bridges, culverts). Once the habitat has been repaired, monitoring of the resulting geomorphic (movement of sediment), hydrologic, and riparian processes (side-bank maintenance, alteration) is required. It is essential that one evaluates the effectiveness of the alterations for the biological and physical processes of the watershed following restoration.

Introduction

Population of salmonids in Pacific Northwest have decreased. Land use and other natural processes have destroyed or restricted spawning habitats. Many people have put time and money into restoring watershed areas that once harbored large populations of salmon, and now are lacking healthy aquatic life. Although there are special measure that must be taken when making restoration efforts. There are a number of factors that affect how a site specific watershed system works, and to be able to understand how to make a healthy freshwater habitat in the long run, we must take a look at the natural and artificial processes that are currently taking place before making alterations. There are however a number of ways to change the processes of a river to benefit the regrowth of a population. This poster will explain specifically some of the measures and methods being taken to ensure the prosperity of the salmonid population within large and small river systems.

Figure 1. Example of restoration efforts on Santiam River.

Project Overview

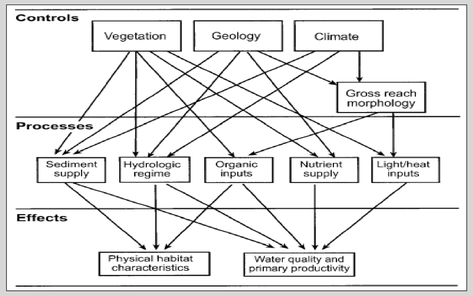


Figure 2. Diagram of linkages between landscape controls and habitat forming processes, also the linkages between habitat forming processes and effects on habitat conditions.

Watershed Processes: OWEB (2000) defined a 'watershed' as an "area of land that drains downslope to the lowest point." This is any fresh water system that flows under the influence of gravity towards the ocean. There are a number controls (geology, climate, etc.) or factors that influence the condition of a watershed system, and in the case of the project we want to influence the factors that will make the stream or river a suitable habitat for salmon and other freshwater fish species. So to create a successful habitat in the long run current situation of natural and artificial processes at play in the area. Natural processes include: sunlight/energy input, Hydrologic regime, sediment and debris supply, nutrient input, and organic material, and riparian processes. Artificial Processes include: Land use, grazing and agriculture, and artificial blockages. (dams, culverts, etc.)

Off-Channel/Isolated Habitats: Roni (2002) stated that "Off-channel (sometimes habitats such as freshwater sloughs, alcoves, wall-based channels, ponds, wetlands, and other permanently or seasonally flooded areas are important rearing areas for juvenile salmonids." This directly applies to the topic at hand since the increase population of salmon is directly affected by the quality of these areas.

Riparian Area: Often the area on the stream bank of a watershed system. Vegetation, composition of rocks and other sediments, and land use of a riparian can alter a watershed system in ways that can both benefit and destroy salmonid habitats.

Instream Habitat: Kauffman (1997) said that "Large woody debris or boulder placement has become one of the most common techniques to improve fish habitat and compensate for the simplification (loss of habitat complexity) of stream habitat caused by decades of land-use practices (Kauffman et al. 1997)." This is important since instream habitat restorations efforts attempt to mimic natural processes like (rock fall, tree falling) that add to a high quality fish habitat.

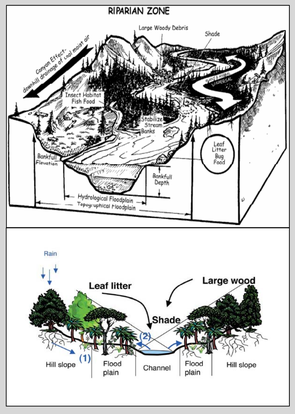


Figure 3. Diagram of the processes and other elements that form the Riparian Zone.

Restoration Methodology

Road improvement technique	Hydrology	Sediment delivery: Fine	Sediment delivery: Coarse
Removal of roads	×	×	×
Culvert or stream crossing upgrades (correct unstable crossings)		×	×
Sidecast removal or reduction		×	×
Reduce road drainage to stream[a]	×	×	
Increase surface material thickness or hardness with crushed rock or paving		×	
Traffic reduction (unpaved roads)		×	

[a] Drainage reduced through increased crossings and by diverting water onto forest floor.

Table 1. Processes restored by some current road improvement techniques. (x) signifies process that is restored to watershed system.

Methods for Habitat Repair

Culverts and Fish Passage Systems: Artificial paths that connect watershed systems, but cut off migratory pathways.

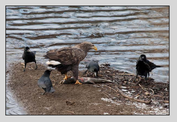
Roadway Improvements: Erosion of roadway can cause problems for salmon habitats. To prevent harm, drainage from roadways is often tried to be dumped on forest land rather in watershed systems containing salmon.

Riparian Restoration: Methods are often to prevent erosion of river bank (slow geomorphic processes) and provide shade to keep water temperatures down. Stabilize ground to prevent landslides. Usually tall large woody plants are used, since they are believed to produce the best results for salmonid habitats.

Instream Restoration: Efforts have been made to add log blockages, boulders, and other artificial structures to reduce water velocities and provide hiding areas for juvenile and spawning adult salmon.

Figure 4. Instream restorations made to Shitike Creek on the Warm Springs Indian Reservation near the Deschutes River. (http://wsfish.org/deschutes-restoration/)

Carcass and Nutrient Placement: Hatchery salmon carcasses and other means of artificially adding nutrients (tablets etc.) and organic matter to improve habitat conditions for salmon. Measures must be taken to prevent an excess build up of nutrients down stream.



Conclusion

The population of salmon in the Pacific Northwest has been impacted by human use. There are three steps that researchers believe will improve the circumstances, and they are (1) assessment of watershed processes, (2) protecting already existing high-quality habitats, and (3) understanding effectiveness of current techniques for habitat rehabilitation. There are a number of methods that are employed to improve habitat of salmon populations. To truly understand how to improve the watershed habitat area an understanding of the processes at play are essential. Construction near or around watershed systems should be monitored and should try to effect river systems in the smallest amount possible. However some artificial instream blockages and restoration attempt may be useful to aiding in habitat restoration for spawning salmon.

References

Roni, P., Beechie, T. J., Bilby, R. E., Leonetti, F. E., Pollock, M. M., & Pess, G. R. (2002). A Review of Stream Restoration Techniques and a Hierarchical Strategy for Prioritizing Restoration in Pacific Northwest Watersheds. North American Journal of Fisheries Management, 22(1).

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