A Brief Guide to Restoring Salmonid Habitat-forming Processes in Pacific Northwest Watersheds

Modifications intended to improve habitat conditions for salmonids (e.g., placing large woody debris in streambeds, creating spawning habitat or protecting stream banks) are often unsuccessful because they address symptoms, not causes of habitat degradation. Neglecting the physical and biological processes that cause degradation can lead to physical failure of stream restoration projects or to increased maintenance costs for those projects. Researchers at the University of Washington's Center for Streamside Studies have evaluated traditional and new approaches for habitat restoration.

Traditional approaches to restoration have focused on creating specific habitat conditions rather than on restoring the processes that create and sustain salmonid habitat. This approach often leads to projects that attempt to create stable conditions. Yet, rivers are dynamic systems, and it is the disturbance processes in rivers (floods, tree-fall, fires) that create the complex matrix of habitat that salmon need for their different life stages. Attempts to stabilize habitats can interrupt long-term processes that generate the diversity of habitats needed by salmonids and other stream organisms.

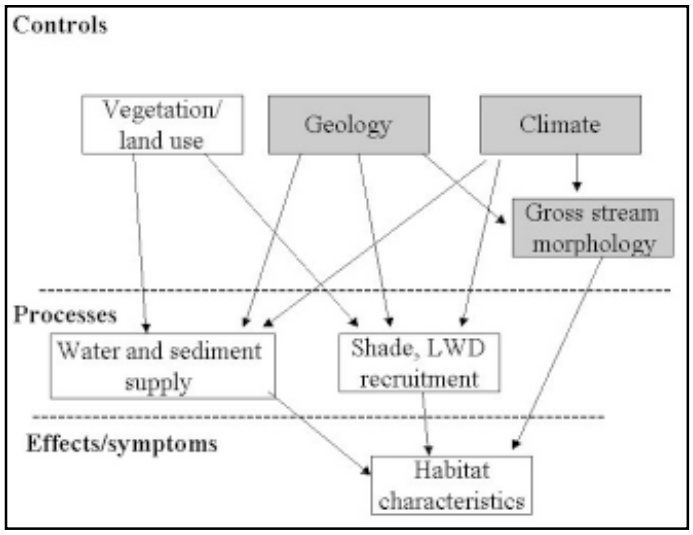

Figure 1 shows linkages among controls on watershed processes, processes themselves, and habitat characteristics. Shaded boxes indicate controls that are not affected by management activities. Gross stream morphology refers to average channel slope, approximate size of channel and floodplain width. Habitat characteristics include pool/riffle sequences, sediment size, and frequency of LWD.

A different approach for restoration is to restore and manage watershed processes that create and maintain habitat. This approach concentrates on diagnosing and treating causes of habitat degradation rather than the symptoms of habitat degradation (Figure 1).

A watershed's land base controls its processes. Putting all restoration efforts into the stream channel ignores the effects of land use and vegetation cover on the supply of water, sediment, shade, and wood to the streams. Past errors, based on doing things thought to be 'good' for salmon, like removing wood, should be less likely to occur if the restoration goal is to reestablish processes to which salmonids have adapted. In addition, by looking at watershed processes instead of individual salmon species habitat requirements, actions can be identified that restore habitat for all salmonid species. This approach requires analysis of habitat forming processes at the watershed scale in order to identify processes that have been disrupted as well as the locations and timing of land use effects on those processes. There are five steps in implementing this approach.

1. Estimate historical rates of habitat-forming processes

This requires an understanding of the important processes in the watershed. Examples of important processes include historic fire frequencies, sediment supply rates, growth and yield of riparian forests, stream temperature regimes, and frequencies and sizes of landslides and floods.

2. Assess changes in rates of habitat-forming processes

This requires identifying land use changes that have altered habitat-forming processes and determining which changes most likely created a change in important processes. Examples of data that may illustrate changes include hydrographs, channel morphologies, stream temperatures and vegetation ages and types.

3. Identify restoration tasks

Decide on the physical and biological objectives for the site, and then identify the actions required to achieve each objective. In urban and agricultural areas, the types of actions may be severely constrained by current land use. Here the goal is to be sure that all actions will move towards the goal of restoring habitat-forming processes even if full restoration will not be possible given current land use.

Restoration may be passive or active. Passive restoration involves mapping sensitive areas and prohibiting activities in those areas. Active restoration includes actions such as removing culvert blockages for fish passage, identifying and repairing road failures, and identifying riparian areas for thinning or planting to enhance recovery of the desired size and species of trees.

4. Evaluate effectiveness of restoration tasks

The methods used to evaluate options vary with the physical and biological objective and site. In some cases, habitat-based fish production models can be used. In other cases, the evaluation will be more qualitative and look at things like the effect of changing temperature, sediment, or hydrologic regimes on species of interest.

5. Prioritize actions based on costs and potential for achieving the biological objective

Ideally, projects are ranked based on the greatest change in biological indicator per dollar cost. However, other factors often must be considered, such as recovery time, landowner willingness to participate, and funding availability for various projects.

For more information, see
Beechie, T. and S. Bolton. *An approach to restoring salmonid habitat-forming processes in Pacific Northwest watersheds.* Fisheries 24(4):6-15.

Contact: Center for Streamside Studies
University of Washington, Box 352100
Seattle, WA 98195-2100
(206) 543-6820; Fax (206) 543-3254
cssuw@u.washington.edu