salmon restoration

A brief guide to

Restoring salmonid habitat in Pacific Northwest watersheds

Modifications intended to improve habitat conditions for salmonids (e.g., placing large woody debris, 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.

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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 these rivers (floods, tree-fall, fires, etc.) 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.

A different approach to restoration is to restore and manage watershed processes responsible for creating and maintaining habitat. This approach concentrates on diagnosing and treating causes of habitat degradation rather than the symptoms of habitat degradation (see figure on back).

The stream network is inextricably tied to its catchment. Upslope processes shape stream network dynamics. Therefore, focusing restoration efforts only on the stream channel ignores processes esssential to the development and maintenance of stream habitat (e.g., water and sediment delivery, shade, large wood input). Past errors, based on doing things thought to be 'good' for salmon, like removing instream wood, should be less likely to occur if the restoration goal is to reestablish processes to which salmonids have adapted. In addition, by focusing on watershed processes rather than individual species habitat requirements should restore habitat for all species. This restoration approach requires analysis of habitat forming processes at the watershed scale to identify those processes that have been disrupted by land-use activities. There are 5 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 assessing the magnitude of rate change associated with various land-use activities. Examples of data that may illustrate changes to habitat forming processes include hydrographs, channel morphologies, stream temperatures, and vegetation ages and types.

3. Identify restoration tasks

Identify physical and biological objectives for the watershed, 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 activities involve mapping of sensitive areas and prohibiting activities in those areas. Active restoration include actions like 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 restoration options will vary with the physical and biological objective and watershed. In some cases, habitat-based fish production models can be used. In other cases, the evaluation will be more qualitative and look at factors like the effect of changing temperature, sediment or hydrologic regimes on species of interest.

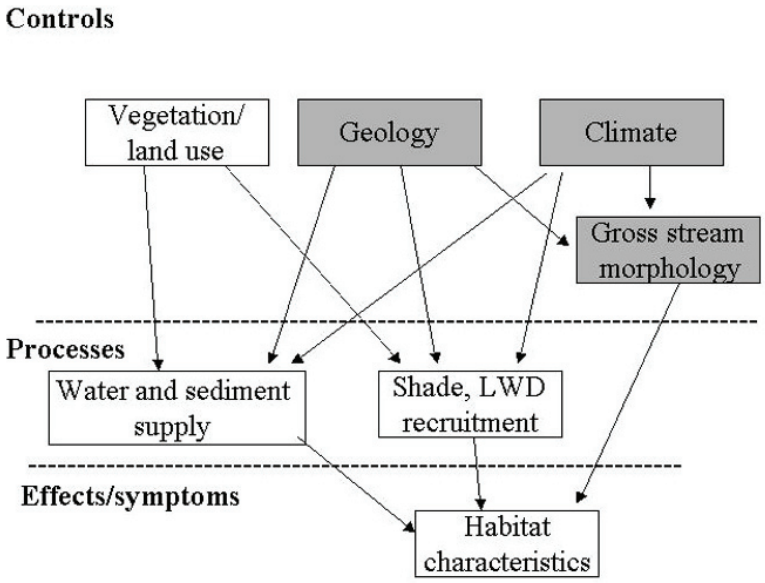

Figure 1 shows linkages among controls on watershed processes, processes themselves, and habitat characteristics. Shaded boxes indicate controls that are not affected by management activities. Gross stream morphology refers to average channel slope, approximate size of channel and floodplain width. Habitat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

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.

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