2018

QUARTZ CREEK RESTORATION PROJECT

AQUATIC ECOSYSTEM RESPONSE

background

Complexity and diversity of Pacific Northwest streams is strongly influenced by large wood. Large wood creates pools, stores inorganic sediments and organic matter, and creates a stepped channel profile. Wood causes abrupt and persistent changes in channel patterns and position, and is the major structural element responsible for backwater and side-channel formation. Large wood maintains habitat for fish by altering velocities, providing forage sites, and trapping organic matter allowing for biological processing. Wood also provides protection from predators, shelter during high winter flows, and an important substrate for invertebrates.

Removal of large trees from riparian forests during logging, stream cleaning and salvage operations, and short-rotation timber practices have altered sources and delivery rates of large wood to stream channels contributing to the decline in salmonid populations. Over the past several decades, this decline has prompted resource managers to emphasize restoration of aquatic habitats in the Pacific Northwest.

the project

A long-term project was initiated in 1988 by the Willamette National Forest and Oregon State University to evaluate the changes in the geomorphic, hydraulic, and biological attributes associated with the installation of log accumulations in a habitat restoration project. Objectives of the project were to 1) reestablish natural volumes of large wood 2) provide complex wood accumulations for salmonid habitat 3) increase availability of floodplain and off-channel refuges 4) increase fish habitat 5) increase the residence time of water, nutrients, and food resources.

The project was designed to introduce and recruit large wood in size classes and volumes that occur naturally in undisturbed streams of similar size and gradient in the McKenzie River basin. Quartz Creek was selected as the site because relatively low amounts of wood were present in the channel due to past disturbances and salvage logging operations.

Full channel jam, Quartz Creek, 1997.

Pre-treatment geomorphic and biological features of Quartz Creek were measured in early 1988. Reference reaches also were studied both above and below the proposed restoration reach. Larger size classes of wood (generally greater than 5 m in length and 50 cm in diameter) were placed in the stream to create a matrix of large stable wood that would trap smaller sizes. Forty-eight log and boulder structures were installed in September 1988. Trees used for log accumulations consisted primarily of western red cedar and Douglas-fir. Channel structure, hydraulic and particulate retention, large wood, and fish populations were monitored each year from 1989 to 1993. The site was resampled in both 1996 and 1997 to determine the effects from the two large floods that inundated the Pacific Northwest in 1996.

results

Prior to the project, 212 pieces of wood were located within the 1,100-m restoration reach. In the ten years since treatment, the restoration reach at Quartz Creek has developed the amounts and sizes of wood that would be expected in a similarly sized stream flowing through an old-growth forest in this basin. By 1997, there were 2,190 pieces of wood in the Quartz Creek restoration reach.

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Fish densities in many streams in Oregon and Washington decreased after the two floods of 1996. In Quartz Creek, fish abundance increased by 47% in 1996 and had relatively no change in 1997. This increase in the fish population could be related to the greater amount of wood which allowed for winter refuge even during the large flood events of 1996. Estimates of trout populations for the 10-yr period after restoration averaged 21% higher than the population observed in 1988.

Length of stream in pool habitat changed from 10% before structure installation to 16% by 1997, 10 years after structure installation. Before structure installation the restoration site had 6% of its length in side-channels but in 1997, 27% of the total length of stream channel was side-channel habitat. Pools and side-channels provide important habitats for all life history stages of trout.

Channel scour or deposition have been observed in association with most of the accumulation. Overall depth and composition of the streambed remained relatively stable, but large amounts of spawning gravel have been deposited at several locations.

Retention of potential food resources (measured by leaf releases) increased approximately 3.5 times by 1996, eight years after log introductions. We anticipate particulate retention will continue to increase as smaller wood continues to become entrained and incorporated into the log accumulations.

Seven types of log accumulations and three degrees of steel cabling were used to evaluate their effectiveness and longevity. Of the 48 instream log accumulations installed, 21 moved more than one meter during high winter discharges. Cabling in the log accumulations made no difference on which structure moved. Only 21 of the 186 pieces (11.3%) of the wood originally installed have been transported out of the restoration reach. Most of the transported pieces have been relatively small in size, with a mean length of 4.1 m and a mean diameter of 0.47 m.

Most of the log accumulations that moved more than one meter since installation in1988 are still performing valuable ecological functions. In many respects, effective redistribution of wood by the stream is a more desirable ecological response than remaining in an original fixed position.

This aquatic ecosystem restoration project resulted in several major physical and biological changes in Quartz Creek in a relatively short period of time. Recruitment of large wood by the accumulations has been particular encouraging. The long-term effectiveness of the project for channel processes and aquatic biota still remains to be seen.

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Gregory, Stan; Wildman, Randy. 1998. **Aquatic ecosytem restoration project: Quartz Creek post-flood progress report.** Willamette National Forest. Eugene, OR. 75 pages.

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