

## A Riverscape Perspective of Salmon Habitat Assessment on Tribal Ceded Lands

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The Columbia River Inter-Tribal Fish Commission (CRITFC) is conducting a monitoring program in the upper Grande Ronde River and Catherine Creek basins designed to evaluate whether aggregate habitat restoration actions can positively affect ESA-listed spring Chinook salmon populations. According to literature, common impediments to salmon survival are high water temperatures, fine sediment in spawning gravel, loss of riparian vegetation, channelization, lack of large woody debris in the channel, loss of large pools for adult fish to hold in prior to spawning, and summertime depletion of streamflows. However, the effects on salmon of these and other factors are often inter-correlated and the influence of each is dependent upon the entire suite of relationships, which can be difficult or impossible to tease out using classic univariate statistics. This presentation describes a “riverscape approach,” including the use of landscape classification, multivariate analyses, and structural equations modeling as tools for simplifying complex relationships. A multivariate ordination was conducted of reach-scale habitat data collected by the Columbia Habitat Monitoring Program (CHaMP) in 2011 across nine watersheds in the Pacific Northwest to discover an appropriate landscape-level classification, which in turn helped reveal patterns of anthropogenic impacts on site-level fish habitat. In the upper Grande Ronde River basin, estimates of juvenile Chinook salmon density (via snorkeling) were linked to landscape classification and site-level habitat conditions. Across the entire basin, large woody debris volume and frequency of pool area positively affected fish density, but their effects were swamped by mean annual streamflow. However, these relationships varied across landscape classes, with high elevation mountain reaches behaving differently than lower elevation floodplain and constrained reaches. These results demonstrate an approach to habitat modeling that CRITFC is currently employing, with the eventual outcome of informing a habitat-based life cycle model for spring Chinook salmon.