Ecological uncertainty is a function of both environmental and biological variability and represents the Achilles' heel of restoration efforts, particularly in regions lacking basic biological data (e.g., species presence/absence, abundance). Aquatic habitats can be particularly challenging in this regard. The goal of this project is to leverage available hydraulic data sets to quantify and compare the quality of alternative habitats for threatened and endangered salmon. At a minimum, habitat quality for juvenile salmon migrating downstream can be measured by the availability and connectivity of shallow water habitats. Yet, how can we meaningfully encapsulate and compare a region's shallow water habitats and how do we define their connectivity relative to a target species? The value of hydraulic models is that they can provide ecologists with a continuous map of how aquatic habitats change over time. Unfortunately, this very quality, continuity in space and time, presents its own statistical challenges.

Students will be faced with wrangling information from big data sets to compare changes in habitat quality across locations in a large river over time. Beyond data management and visualization, students will have to determine how much physical or biological complexity must be modeled to effectively characterize and compare alternative restoration sites. Challenges will include tackling temporal and spatial covariance in observed metrics (e.g., water depth) and contrasting alternative means of defining habitat connectivity that are both meaningful and tractable.

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