

## Multi-Scale Environmental Filters of Benthic Invertebrate Communities in Mountainous Ecoregions of Oregon and Washington

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**Abstract.** Bioassessments are commonly used to monitor the presence and extent of human impacts to freshwater ecosystems. Problems arise when trying to define expected or “reference” conditions for comparison to current community composition. We examine key physical environmental variables that influence benthic invertebrate communities in mountainous ecoregions of Oregon and Washington to stratify the physical environments of channels where benthic communities may be expected to be similar. Cluster analysis was used to create *a posteriori* benthic community classes of sites and was performed on nested groups of ecoregions to reveal how scale affects our ability to predict class membership and to identify the most relevant environmental variables at each scale. Innovative, multi-scale environmental metrics were computed in a GIS and combined with field-measured variables resulting in an initial pool of 958 environmental variables. Classification techniques were used to construct and validate models for predicting benthic community class membership. The resulting statistical models are well suited for implementation in a GIS and improve our understanding of the linkages between biological communities and multi-scale drivers such as hydrology, hydraulics, geomorphology, and land use. The results provide a framework for developing a physical classification of characteristics that explain variation in benthic communities and aid in the objective identification of reference sites for bioassessments, thereby improving our ability to properly identify impaired reaches.

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