Landscape stream classifications for biomonitoring and the importance of intermediate scales

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Abstract. The importance of valley scale influences on stream ecosystems are widely recognized, yet previous studies have largely failed to demonstrate strong associations between aquatic insects and intermediate scale (between reach and watershed) physical descriptors. Valley metrics derived from geospatial data have the potential to improve the classification of stream habitats with relatively homogenous biological assemblages for biomonitoring and bioassessment. We used a geographical information system (GIS) to describe hydrologic regimes and geomorphic boundary conditions at 222 minimally-disturbed sites in mountainous ecoregions of the Pacific Northwest. We applied these multi-scale metrics to develop *a priori* (without biological calibration) and *a posteriori* (biologically calibrated) classifications of biomonitoring sites and compared them to geographically-dependent classifications (i.e, Level III ecoregions). Similarity in stream insect assemblages within and among classes was used to develop quantitative measures of classification strength for comparing classification performance. *A priori* classifications outperformed ecoregions in 11 of 18 comparisons, indicating that spatially discontinuous geomorphic and hydrologic classifications can partition biological variability better than ecoregions, often with fewer classes. *A posteriori* decision tree models resulted in classification strengths as high as 90% of the maximum attainable from cluster analyses of insect assemblages. Valley-scale metrics describing floodplain presence and stream power as well as hydrologic metrics describing peak flows and low flows yielded consistently strong classifications. This work provides a basis for mapping hydrogeomorphic settings and putative habitat types across landscapes, a framework for process-based stratification in biomonitoring designs, and further reveals the importance of intermediate-scale influences on stream biota.

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