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http://www.waterboards.ca.gov/water_issues/programs/swamp/bioassessment/training.shtml#cabw

Setting Regional Targets Based on Flow-ecology Relationships to Support Biological Integrity

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Abstract
The prevalence of hydrologic alteration, particularly in arid regions, creates a need for tools to assess ecological impacts to streams that can be applied across large geographic scales. Traditional, site-specific approaches are relatively costly, requiring more time, data, and expertise than watershed managers can typically provide at all sites where analysis is needed. A regional framework for biologically-based flow management can help watershed managers tackle the problem at large scales. Specifically, regionally-derived targets for hydrologic alteration can be used to prioritize streams for protection, evaluate impacts of disturbance or interventions, and provide a foundation for causal assessment at degraded streams. We employed an approach based on the ELOHA framework to derive regional biologically-based targets for flow alteration. Making use of a regionally calibrated ensemble of hydrologic models, we estimated current and reference flows at 572 sites where bioassessment samples have been collected in southern and central coastal California. Flow alteration was characterized as the difference in a suite of 36 flow metrics calculated from simulations of current and historic (i.e., reference) flow time-series, calculated under multiple precipitation conditions (121 metric-precipitation combinations total). Biological integrity was assessed with the California Stream Condition Index (CSCI, a predictive index based on benthic macroinvertebrate assemblages), and its components. Logistic regressions were used to predict the likelihood of a healthy biological condition (defined as a score ≥ the 10th percentile of the CSCI reference calibration data). Regressions were conducted independently for both increasing and decreasing alteration gradients. Where models were successful (i.e., significant relationships between increasing severity of hydrologic alteration and decreasing biological condition), a threshold was set at the level of alteration where probability of good condition was half the probability at hydrologically unaltered sites. An index of hydrologic alteration was created by selecting metrics based on their importance for predicting biological response variables in boosted regression tree models. Ranked importance (measured as increased mean-squared error in the model) was averaged across biological response variables; metrics ranked in the bottom half were dropped from further analysis. Metrics were selected in order of decreasing importance, and no more than two metrics per metric-class were selected. Duration, magnitude, frequency, and variability metrics were selected, but no metrics related to timing were selected. Applying the index to data from a probabilistic survey, 34% of stream-miles in Southern California were estimated to be hydrologically altered; alteration was more pervasive

in far urban (91% stream-miles altered) and agricultural (80%) than undeveloped (11%) streams. The most altered metric in the index, HighNum, was elevated at 31% of stream-miles, whereas MaxMonthQ was elevated at only 6%. Management priorities were assigned to each sited based on biological condition and hydrologic status: protection (healthy and unaltered, 52% of stream-miles), monitoring (healthy but altered 4%), evaluation of flow management (unhealthy and altered, 30%), and evaluation of other types of management (unhealthy but unaltered, 14%). Regionally derived, biologically based targets for flow alteration allow watershed managers to rapidly prioritize activities and conduct screenings for causal assessments at many sites across large spatial scales. Furthermore, regional tools pave the way for incorporation of hydrologic management in policies and watershed planning designed to support biological integrity in streams. Development of regional tools should be a priority in regions were hydrologic alteration is pervasive or expected to increase in response to climate change.