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Development of Recommended Flow Targets to Support Biological Integrity Based on Regional Flow-Ecology Relationships for Benthic Macroinvertebrates in Southern California Streams

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Abstract

Changes to instream flow are known to be one of the major factors that affect the health of biological communities. Regulatory, monitoring, and management programs are increasingly using biological community composition, particularly benthic invertebrates, as one measure of instream conditions, stormwater project performance, or regulatory compliance with National Pollutant Discharge Elimination System (NPDES) or other requirements and regulations. Understanding the relationship between changes in flow and changes in benthic invertebrate communities is, therefore, critical to informing decisions about ecosystem vulnerability, causes of stream and watershed degradation, and priorities for future watershed management. We applied to the Ecological Limits of Hydrologic Alteration (ELOHA) framework to develop regional flow-ecology relationships and targets based on responses in the benthic macroinvertebrate community. Our objectives were: 1) Develop a recommended set of flow targets for southern California streams that would maximize the likelihood of maintaining healthy biological communities as indicated by the California Stream Condition Index (CSCI) for benthic invertebrates. 2) Produce a set of tools that can be readily applied to future sites to estimate hydrologic alteration relative to biologically-defined targets. Development of the regional flow-ecology relationships relied on an ensemble of hydrologic models to estimate flow alteration at ungauged sites, and took advantage of a regional bioassessment data that allowed us to assess flow-ecology relationships at broad spatial scales. Our general approach involved developing a hydrologic classification for the entire State of California, calibrating and validating watershed models for the stream classes present in southern California, using the models to assess hydrologic change at 572 bioassessment sites, relating hydrologic change to biological responses, setting targets based on likelihood of biological response associated with changes in key flow metrics, applying the flow-ecology tools to assess regional hydrologic condition, and prioritizing sites for various management actions based on their response relative to the established flow targets.