Sarah Yarnell Abstract

Developing Tier 1 Environmental Flow Targets using a Functional Flows Approach
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Establishing environmental flow targets is a priority for numerous programs in California. Building on previous environmental flow discussions and a growing recognition that hydrogeomorphic processes are inherent in the ecological functionality and biodiversity of rivers, we propose a functional-flows approach to rapidly develop statewide environmental flow recommendations. The approach focuses on retaining specific process-based components of the hydrograph, or functional flows, rather than attempting to mimic the full natural flow regime. Key functional components include wet-season initiation flows, peak magnitude flows, seasonal transition recession flows, dry-season low flows, and interannual variability. The method defines a set of quantitative flow metrics based on the reference or unimpaired hydrologic conditions for each of the California stream classes defined by Lane et al and Pyne et al. Using "dimensionless reference hydrographs", which are scalable representations of the statistical variability in unimpaired flows within a stream class, we calculate the range of values for specific flow metrics that represent components of the hydrograph associated with critical ecological or hydrogeomorphic functions. The values for each functional flow metric can then be appropriately scaled to a stream of interest and serve as initial Tier 1 flow management targets. Tier 1 flow targets can be further refined by additional site-specific analyses under Tier 2 approaches as defined in the California Environmental Flows Framework. We suggest this approach allows for the rapid development of flow regimes that encompass ecosystem processes alongside varied human needs and can be applied in an adaptive management framework allowing for changing conditions and needs.