

# A freshwater conservation blueprint for California: prioritizing watersheds for freshwater biodiversity

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**Abstract:** Conservation scientists have adapted conservation planning principles designed for protection of habitats ranging from terrestrial to freshwater ecosystems. We applied current approaches in conservation planning to prioritize California watersheds for management of biodiversity. For all watersheds, we compiled data on the presence/absence of herpetofauna and fishes; observations of freshwater-dependent mammals, selected invertebrates, and plants; maps of freshwater habitat types; measures of habitat condition and vulnerability; and current management status. We analyzed species–distribution data to identify areas of high freshwater conservation value that optimized representation of target taxa on the landscape and leveraged existing protected areas. The resulting priority network encompasses 34% of the area of California and includes  $\geq 10\%$  of the geographic range for all target taxa. High-value watersheds supported nontarget freshwater taxa and habitats, and focusing on target taxa may provide broad conservation value. Most of the priority conservation network occurs on public lands (69% by area), and 46% overlaps with protected areas already managed for biodiversity. A significant proportion of the network area is on private land and underscores the value of programs that incentivize landowners to manage freshwater species and habitats. The priority conservation areas encompass more freshwater habitats/ha than existing protected areas. Land use (agriculture and urbanization), altered fire regimes, nonnative fish communities, and flow impairment are the most important threats to freshwater habitat in the priority network, whereas factors associated with changing climate are the key drivers of habitat vulnerability. Our study is a guide to a comprehensive approach to freshwater conservation currently lacking in California. Conservation resources are often limited, so prioritization tools are valuable assets to land and water managers.

**Key words:** conservation planning, freshwater biodiversity, protected areas, Zonation software, California

Freshwater ecosystems are in peril globally. Threats to freshwater biodiversity are numerous and include habitat degradation, pollution, overexploitation, dam construction, spe-

cies invasion, and hydroclimatic change (Dudgeon et al. 2006, Strayer and Dudgeon 2010, Vörösmarty et al. 2010, Arthington et al. 2016, He et al. 2017). Over the past de-

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417