

Linking Frog Population Monitoring with the FIA Grid: Data Efficiencies and Sample Design Challenges

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Frog populations are declining globally, and persistence of many species is at risk. Frog populations in the Sierra Nevada mirror these global trends, where over half of all frog and toad species are of concern. Over the past 3 years, a comprehensive environmental monitoring program was developed for the Sierra Nevada which adopted the FIA grid system as the primary sample design. The monitoring strategy includes plans for monitoring frog populations, with particular emphasis on the mountain yellow-legged frog and Yosemite toad. We wanted to spatially collocate data collection on frog populations with data collection on other species and habitats to facilitate correlative analysis of trends across aquatic and terrestrial-associated species, including evaluating relationships with the same set of explanatory variables describing environmental conditions in the vicinity of FIA points. These species are both associated with lakes, ponds, and streams, with Yosemite toad also associated with wet meadows, and their geographic ranges overlap to a large degree (approximately 50%). Aquatic habitats are naturally fragmented, and as a result these species exhibit a metapopulation structure. Small populations associated with individual aquatic habitat units and occupancy and population size per size is highly variable from year to year. A two-stage sampling design was used: drainage basins were selected as the primary sample unit, with each basin containing multiple secondary sample units consisting of individual aquatic habitats. This design allows for analysis of trends in occupancy and abundance at both the habitat and basin scales. An intricate series of steps were taken to select basins with known probability to maximize (1) the power to detect trends in each species given that a limited number of basins could be sampled, and (2) the number of sample basins collocated with FIA points.