Habitat suitability through time: using time series and habitat models to understand changes in bird density

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Human-driven changes in climate and land-use are altering ecological systems at an increasing rate, but our ability to predict and plan for these changes may not be keeping pace. The Palomarin Field Station serves as a natural laboratory where ecologists study long-term changes in a songbird community responding to habitat conversion from shrubland to Douglas-fir forest.

We used 28 years of data from Palomarin to evaluate the utility of one of the most commonly used conservation and management tools, the habitat suitability model (HSM), to explain and predict changes in abundance of seven bird species at Palomarin. HSMs were designed to predict species' abundance across space, and are increasingly used to predict trends through time, yet the validity of this application has not been evaluated. For example, if the abundance of a species is strongly influenced by local reproductive rates, density dependence, and interactions of these with vegetation change, then HSMs may fail to provide an accurate prediction of habitat suitability.

By comparing HSMs to traditional logistic population models that incorporate temporal processes, we show that HSMs do well at explaining species trends through time. We also found that for species with low dispersal distances, incorporating temporal trends improves our ability to understand and predict changes in populations.

This study provides a valuable evaluation of one of the most commonly used conservation tools (e.g., Modeling bird distribution responses to climate change) and provides insight into the ecological factors that influence our ability to predict species response to environmental change.

Main Points

Habitat suitability models do a good job at explaining changes in landbird density at Palomarin over a 28 year period.

Models that explicitly incorporate time improve our understanding, particularly for bird species with low dispersal distances.

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