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LANDSCAPE-SCALE EFFECTS OF HABITAT AND WEATHER ON INCREASING AND DECREASING SCALED QUAIL POPULATIONS

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ABSTRACT

Scaled quail (*Callipepla squamata*) have declined over the last half century; however, there is spatial variation within their geographic distribution. Interior populations have increased and peripheral populations have generally decreased. Declines have been attributed to habitat loss and degradation. Scaled quail populations also show interannual fluctuations related to precipitation. Our objective was to determine the relative impact of habitat and weather (i.e., precipitation and temperature) on scaled quail population dynamics. Our hypothesis was that habitat metrics would be more important for decreasing populations whereas weather metrics would be more important for increasing populations. We used publicly available datasets for scaled quail abundance measures (Breeding Bird Survey, Christmas Bird Count), weather (PRISM), and land cover (National Land Cover Data) collected over 3 5-year time periods (1990–1994, 1999–2003, 2009–2013). Data were collected at 2 scales: a route scale (5-km route buffer) and region scale (25-km circular buffer). We developed 25 *a priori* models that fit into 4 "model classes" (habitat amount, habitat fragmentation, matrix quality, weather). Model selection followed a 2-stage approach, where models were initially evaluated within each individual model class, then top models from each class were evaluated in combination to determine a global model. We used mixed-effects models with a negative binomial response distribution, treating route as a random effect. Weather variables were the primary explanatory factor for increasing populations at both scales. Similarly following our hypothesis, habitat variables were generally the most important for decreasing populations, but only at the route scale; weather variables dominated at the region scale. Both abundance datasets provided similar results and explanatory power (R2 ≈ 0.10 for route scale; R2 ≈ 0.27 for region scale), for both increasing and decreasing populations. Comparisons of land cover variables showed increasing populations to have higher amounts of habitat ($p = 0.0028$), higher mean patch area of habitat ($p = 0.0446$), and lower urban cover ($p = 0.0287$). Our hypothesis that weather variables account for more variation of increasing scaled quail populations was generally supported, likely because of increased amounts of habitat in these areas. However, given the low overall explanatory power of our models, it is likely that other factors such as habitat quality may be more important to scaled quail. Increasing temperature and reduced precipitation associated with climate change are likely to exacerbate scaled quail declines both directly and through continued habitat degradation, even within areas with increasing populations.

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