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How Ecological Conditions Shape Human Detection of Birds.

Reliable estimates of species distributions and population trends require accounting for imperfect detection, yet variation in detectability remains a major source of bias in ecological monitoring. It is known that species detection varies with biological traits, survey conditions, and observer differences, but ecological drivers are poorly understood since detailed environmental data are rarely collected alongside survey data. Using bird surveys from the National Ecological Observatory Network (NEON), which are paired with standardized, colocated measurements of vegetation structure, biomass, hydrology, microclimate, and other detailed ecological conditions, we examine how ecological characteristics influence human detection of birds. For each species, we fit occupancy models in which detection probability is modeled as a function of either survey-level or site-level ecological covariates, and we compare these models to a baseline model without ecological predictors. We quantify the direction and magnitude of each covariate's effect on detection and summarize patterns across species by evaluating consistency in effect size and sign. Our results identify ecological conditions that consistently increase or decrease general human detection of birds and provide a basis for understanding and potentially correcting ecological sources of detection bias in bird monitoring programs.

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