

SPECIAL SECTION: HIERARCHICAL MODELS IN AVIAN ECOLOGY

PREDICTING REGIONAL ABUNDANCE OF RARE GRASSLAND BIRDS WITH A HIERARCHICAL SPATIAL COUNT MODEL

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Abstract. Grassland birds are among the most imperiled groups of birds in North America. Unfortunately, little is known about the location of regional concentrations of these birds, thus regional or statewide conservation efforts may be inappropriately applied, reducing their effectiveness. We identified environmental covariates associated with the abundance of five grassland birds in the upper midwestern United States (Bobolink [*Dolichonyx oryzivorus*], Grasshopper Sparrow [*Ammodramus savannarum*], Henslow's Sparrow [*A. henslowii*], Sedge Wren [*Cistothorus platensis*], and Upland Sandpiper [*Bartramia longicauda*]) with a hierarchical spatial count model fitted with Markov chain Monte Carlo methods. Markov chain Monte Carlo methods are well suited to this task because they are able to incorporate effects associated with autocorrelated counts and nuisance effects associated with years and observers, and the resulting models can be used to map predicted abundance at a landscape scale. Environmental covariates were derived from five suites of variables: landscape composition, landscape configuration, terrain heterogeneity and physiognomy, climate, and human influence. The final models largely conformed to our *a priori* expectations. Bobolinks and Henslow's Sparrows were strongly sensitive to grassland patch area. All of the species except Henslow's Sparrows exhibited substantial negative relations with forest composition, often at multiple spatial scales. Climate was found to be important for all species, and was the most important factor influencing abundance of Grasshopper Sparrows. After mapping predicted abundance, we found no obvious correspondence in the regional patterns of the five species. Thus, no clearly defined areas exist within the upper midwestern United States where management plans can be developed for a whole suite of grassland birds. Instead, a larger, region-wide initiative setting different goals for different species is recommended.

Key words: abundance, Bobolink, Grasshopper Sparrow, Henslow's Sparrow, hierarchical model, Sedge Wren, Upland Sandpiper.