

Patuxent Wildlife Research Center

Development of Patch Occupancy Models for Assessing the Spatial Distribution of Organisms



The Challenge: A variety of important questions about the conservation and management of natural resources requires information about the spatial distribution of organisms. For species of conservation concern, the size of a species' range is a criterion used to assign species status as threatened or endangered. For invasive species and disease organisms, the dynamics of the species range expansion are relevant to efforts to both control invasions and to protect vulnerable species. In this period of rapid global change, it will be important to be able to understand and predict dynamics of species ranges as habitats change in suitability.



The Science: "Range maps" of organisms are widely published in such places as field guides for various types of organisms. However, typical range maps are not very useful for many of the important questions involving conservation and management. Thus, USGS scientists have developed an inferential framework known as occupancy modeling. Such models permit inferences about species occurrence and occurrence dynamics in the face of nondetection. This framework was developed within the last decade and has become one of the most widely-used methodological approaches in all of ecology and conservation.



The Future: The future of occupancy modeling includes both methodological development and conservation application. New methodological developments include multistate models, models that incorporate both habitat and species dynamics, models that include effects of neighbor locations, and models that include not only nondetection, but also errors in species identification (false positives). Exciting conservation applications focus on a variety of invasive species problems (e.g., barred owls in the Pacific northwest), endangered species management (e.g., conservation of Florida scrub jays), and predicted consequences of global change (avian responses to land use and climate change). USGS has played a leadership role in the development of occupancy models and is poised to broaden this leadership to include conservation applications.