Sensitivity of wildlife habitat capability models to spatial resolution of underlying mapped vegetation data

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Abstract: Regional studies of wildlife habitat capability often involve analysis of mapped vegetation information using moving focal windows. Different filters may be used to calculate indices for different habitat needs such as nesting and foraging, which are then combined into a composite model. Typically, sensitivity analyses for these habitat capability index (HCI) models study effects of focal window size or different algorithm formulations but ignore potential impact of the spatial resolution of the underlying vegetation information.

We used detailed vegetation maps and HCI models developed for coastal Oregon to test HCI model sensitivity to varying spatial resolution of vegetation maps which had been classified to describe habitat elements for a focal species. Our objectives were to: (1) examine effects of spatial resolution of vegetation maps on estimates of area and variability of different habitat elements, and (2) assess effects of spatial resolution on HCI scores (and sub-indices) for focal species that have been considered sensitive to forest disturbance.

We used Gradient Nearest Neighbor (GNN) imputation to create vegetation maps at a range of resolutions (900 m^2, 8100 m^2, and 72,900 m^2 cell sizes), and used them as input to HCI models for the northern spotted owl (NSO) and the western bluebird (WBB). The GNN method applies direct gradient analysis and nearest neighbor imputation to ascribe detailed ground attributes of vegetation to each cell in a regional landscape. The GNN maps were created by first resampling the spatial explanatory variables (e.g. Landsat TM, climate, topography) to coarser resolutions and then running GNN imputation at each resolution. The HCI models contain both nesting and foraging components, which use focal windows at the patch and landscape scales respectively.

At increasingly coarser resolutions, the GNN predictions resulted in slight decreases in area of early-successional, open-canopy forest, and increases of closed-canopy, medium-tree stands. Predictions of habitat capability for the WBB, an early-succession specialist, were dramatically reduced with increasingly coarse resolution. In contrast, habitat capability for the NSO (associated with late-successional forest) increased -- largely due to predictions of more contiguous, older, closed-canopy habitat. Our results suggest that HCI models are sensitive to changes in the resolution of mapped forest conditions. As fine-resolution imputation maps become increasingly available, users need to be aware that how they choose to rescale these maps can strongly influence their analyses.

Keywords: Habitat capability modeling, spatial resolution, sensitivity analysis, Gradient Nearest Neighbor, imputation mapping

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