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The Use of Remotely Sensed Data to Model Habitat Selections of Pileated Woodpeckers (Dryocopus pileatus) in Fragmented Landscapes

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Abstract : Light detection and ranging (LiDAR) and four-channel red, green, blue, and near-infrared (RGBI) remote sensed imageries allow an accurate quantification and contiguous measurement of vegetation characteristics and forest structures. This information facilitates the generation of habitat structure variables for forest species distribution modelling. However, applications of remote sensing data, especially the combination of structural and spectral information, to support evidence-based decisions in forest managements and conservation practices at local scale are not widely adopted. In this study, we examined the habitat requirements of pileated woodpecker (Dryocopus pileatus) (PW) in Hamilton County, Ohio, using ecologically relevant forest structural and vegetation characteristics derived from LiDAR and RGBI data. We hypothesized that the habitat of PW is shaped by vegetation characteristics that are directly associated with the availability of food, hiding and nesting resources, the spatial arrangement of habitat patches within home range, as well as proximity to water sources. We used 186 PW presence or absence locations to model their presence and absence in generalized additive model (GAM) at two scales, representing foraging and home range size, respectively. The results confirm PW's preference for tall and large mature stands with structural complexity, typical of late-successional or old-growth forests. Besides, the crown size of dead trees shows a positive relationship with PW occurrence, therefore indicating the importance of declining living trees or early-stage dead trees within PW home range. These locations are preferred by PW for nest cavity excavation as it attempts to balance the ease of excavation and tree security. In addition, we found that PW can adjust its travel distance to the nearest water resource, suggesting that habitat fragmentation can have certain impacts on PW. Based on our findings, we recommend that forest managers should use different priorities to manage nesting, roosting, and feeding habitats. Particularly, when devising forest management and hazard tree removal plans, one needs to consider retaining enough cavity trees within high-quality PW habitat. By mapping PW habitat suitability for the study area, we highlight the importance of riparian corridor in facilitating PW to adjust to the fragmented urban landscape. Indeed, habitat improvement for PW in the study area could be achieved by conserving riparian corridors and promoting riparian forest succession along major rivers in Hamilton County.

Keywords : deadwood detection, generalized additive model, individual tree crown delineation, LiDAR, pileated woodpecker, RGBI aerial imagery, species distribution models
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