Economics of Optimal Placement of Stopover Sites for Migratory Bird Species

2021 John Tschirhart Graduate Scholarship in Bioeconomics

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Many populations of migrating species are under threat from climate change and the conversion of important stopover habitat to human uses. In a time of rapidly changing environments, conserving habitat is critical to the survival of many these migrating species. This problem is most often rectified with easements, which serve to maintain or enhance stopover habitat important for migrations largely dominated by agricultural land. However, there exists a gap in both the economic and ecologic literature that evaluates easement policy. Currently, economics evaluates policy to conserve species on specific patches, but ignores the behavioral responses of migrating species to habitat changes. This is also true of the ecological literature in that migration is modeled in fine detail, but behavior responses to the implementation of a conservation area is largely ignored. To bridge this gap in the literature, this funded work attempts to find the circumstances under which conditions one large stopover habitat is more cost-effective than two small stopover patches.

To answer these questions in the context of avian migration, I use a Stackelberg leadership model in which the conservation manager acts as the Stackelberg leader who maximizes bird survival by setting the location and area of a conservation area and must incorporate the optimal behavior responses of the birds to changes in the landscape. The survival rate of the birds is a spatial bio-economic model that incorporates both economic and ecological trade-offs. The birds optimize subject to a time constraint and the manager optimizes subject to a budget constraint.

The simple version of the model described above will be used to evaluate my first research condition. This framework will incorporate two novel features: (1) a realistic behavioral model of the migrating birds, and (2) cost-effective analysis of the manager's conservation

decisions with the birds' best response function incorporated as a constraint. I will use this framework to estimate the potential gains in the migrating birds' survival rates and the opportunity for cost savings that an optimizing manager could achieve by accounting for the birds' behavioral responses in contrast with traditional reserve site selection methods that treat the target species as passive agents. The model is currently being parameterized to realistic assumptions regarding migrating birds and will undergo a large sensitivity analysis to ascertain key features of the model that should be considered for conservation policy.