

The Effects of Wetlands and Forest Opening Size on the Richness and Abundance of Early-Successional Birds

Hildesheim, Isabel, Department of Biological Sciences, Roanoke College

Faculty Mentor: David Brown, Katie Kelly

NSF-Research Experiences for Undergraduates, Disturbance Ecology in Central Appalachia 2018

Introduction

Early-successional forests, also known as forest openings, are a specific habitat type that have little to no canopy cover and are composed of mainly shrubs and small plants that cannot survive within mature forests due to a lack of light. They are created through a variety of natural and anthropogenic disturbances such as wildfires, ice storms, beaver activity, silviculture, abandoned agriculture, and maintained clear cuts that are created through logging activities as well as mowing. These forest openings are home to many species of birds that rely on this specific habitat type during breeding season. Early-successional birds are rarely found within other habitat types, especially mature forests. There are many aspects of forest openings that influence bird populations including the patch size and vegetation structure of the openings (King and Schlossberg, 2014).



Figure 1. Forest opening within the Cumberland Ranger District of The Daniel Boone National Forest

The abundance of early-successional forests has been declining due to the prevention of the natural and anthropogenic disturbances that help to create these forests, an increase in forests that are no longer prone to disturbance, and push back from the general population who view mature forests as superior to early-successional forests. As a result, the early-successional birds that depend on this habitat are also declining and are now of conservation concern (King and Schlossberg, 2014). The objectives for this project were to

determine how the size of the opening and the presence of wetlands affected the abundance and richness of early-successional birds and to provide the U.S. Forest service with information that can be used to create future management plans for maintained early-successional forests. Specifically, I predicted that if wetlands were present within the forests openings, then there would be a greater species richness and abundance of early-successional birds due to optimal breeding habitat and an abundance of food provided by the specific vegetation structure.

Methods

Point counts were used to collect data on the richness and abundance of early-successional birds (USFS 1996). We modified the standard USFS protocol to include 5 minutes of playback where a recording of various bird calls were played in an attempt to attract cautious birds that may have been missed during the first ten minutes. These point counts were conducted at 27 forest openings within the Cumberland Ranger District of the Daniel Boone National Forest in Eastern Kentucky from late May to late June. They were located and chosen using GIS. The forest openings were grouped as either small (less than 0.8 ha) or large (greater than 0.8 ha) and either had or did not have a wetland present. Sampled sites were at least 200 m from other forest openings that were included in the study, and at least 100 m from lake shores. Most of the forest openings, and the majority of the openings maintained by the USFS, were small. Data on the vegetation of each opening was recorded using a modified version of the Bird Point Count Habitat Sheet described by the USFS in 1996. Eleven early-successional species were selected to be used as indicator species. These species were blue-winged warbler (*Vermivora cyanoptera*), cerulean warbler (*Setophaga cerulea*),

field sparrow (*Spizella pusilla*), eastern towhee (*Pipilo erythrophthalmus*), prairie warbler (*Dendroica discolor*), indigo bunting (*Passerina cyanea*), yellow-breasted chat (*Icteria virens*), common yellow-throat (*Geothlypis trichas*), white-eyed vireo (*Vireo griseus*), Kentucky warbler (*Oporornis formosus*), and brown thrasher (*Toxostoma rufum*). All statistical analyses were conducted by performing two-way ANOVAs using R-Studio.

Results

A total of 439 birds were detected during the point counts. Of these, 136 were indicator species. The indicator species richness was influenced by the size of openings ($F_{1, 23} = 21.3$, $P < 0.001$). The large openings had a greater average species richness than small openings. The presence or absence of wetlands did not influence the average indicator species richness ($F_{1, 23} = 23.138$, $P = 0.25$). There was also no interaction between wetland presence and patch size ($F_{1, 23} = 1.95$, $P = 0.17$).

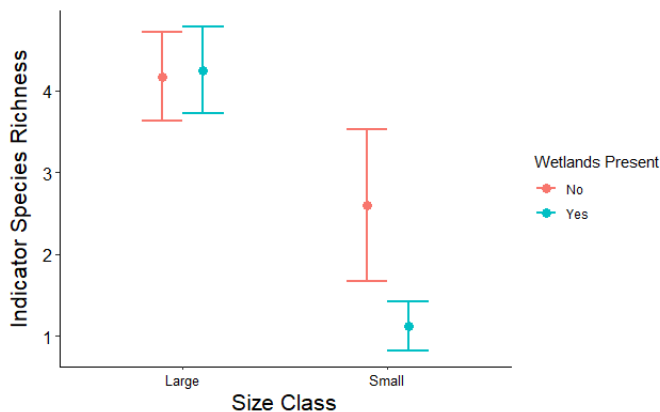


Figure 2. Mean (± 1 SE) indicator species richness in relation to opening size and presence or lack of wetland.

We also investigated patterns of abundance for the five species with greatest total abundance of the eleven indicator species: Indigo bunting, blue-winged warbler, common yellowthroat, white-eyed vireo, and yellow-breasted chat. The species that had a greater average abundance in the large openings were indigo bunting ($F_{1, 23} = 6.45$, $P = 0.02$), yellow-breasted chat ($F_{1, 24} = 14.4$, $P < 0.001$), and common yellowthroat ($F_{1, 24} = 24.13$, $P < 0.001$). White-eyed vireos ($F_{1, 23} = 0.80$, $P = 0.38$) and blue-winged warblers ($F_{1, 23} = 1.13$, $P = 0.30$)

were not influenced by the size of the openings. Out of these five species, only blue-winged warblers had a greater average abundance in openings without wetlands ($F_{1, 23} = 6.01$, $P = 0.02$). Four species were not influenced by the presence or absence of wetlands.

Discussion

We found that the species richness and abundance of early-successional birds were not influenced by the presence of wetlands within forest openings, but that they were influenced by the size of the forest opening. The early-successional birds were more abundant within the larger openings. Therefore, it can be assumed that early-successional birds prefer to inhabit larger openings during their breeding season. This could be a result of optimal nesting opportunities and greater food availability provided by the habitat type and vegetation structure (Moorman, 2011). Further research that looks specifically at the vegetation structure of the forest openings is needed.

Due to the declining populations of early-successional birds, it is imperative that forest opening management plans be implemented. This could include maintaining a greater number of large forest openings since early-successional birds have been shown to prefer large over small openings. Another management technique could be mowing the openings after the primary nesting season (May-June) since the openings are heavily used as breeding sites during this period. The results of this research can also be used by the USFS as baseline data that will allow them to see if new management techniques (such as feathered edges) are positively or negatively influencing early-successional birds.

References

- King, D.I., and S. Schlossberg. 2014. Synthesis of the conservation value of the early successional stage in forests of eastern North America. *Forest Ecology and Management* 324: 186-195.
- Moorman, C. E., D.C. Guynn Jr. 2001. The Effects of Group Selection Opening Size on Breeding Bird Habitat Use in a Bottomland Forest. *Ecological Applications* 11: 1680.
- United States Forest Service (USFS). 1996. The Southern Forest's Migratory and Resident Landbird Conservation Strategy.

Acknowledgements: Dr. David Brown, Dr. Stephen Richter, and Katie Kelly – EKU. Christy Wampler – USFS.