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Using GIS to map M.O.F.E.P bird species nests

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Digitizing 20 Years of M.O.F.E.P. Nest Data for Spatial Analysis

By: Jonathan Spickelmier

Introduction

M.O.F.E.P (Missouri Ozark Forest Ecosystem Project) is a 100 yearlong study that started in 1991 aiming to investigate the long-term effects of logging on forest ecosystem dynamics. A key pillar of the MOFEP project is the Interior bird study which has the objective to "quantify the effects of even-age, uneven-age, and no forest management on the species composition, density, and reproductive success of forest songbirds".

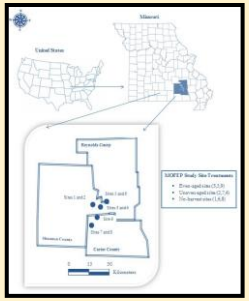
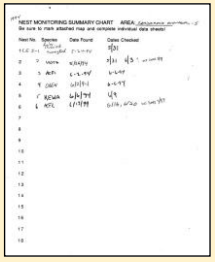


Figure : A map showing MOFEP's location within Missouri

Figure 2: An Acadian Flycatcher feeding it's offspring

Because of its long-term nature, the early years of the MOFEP bird project saw data collection occurring manually using paper datasheets. Throughout the years much of the data has been digitized in parts or chunks depending on the study and research the data pertains to. One significant area that had been neglected in this digitization effort is the geographic location data for where nests were observed. Recent data collection seasons have employed handheld GPS devices to record nest locations on the spot to mitigate this issue, but there still existed a large dataset without digitally usable location data.



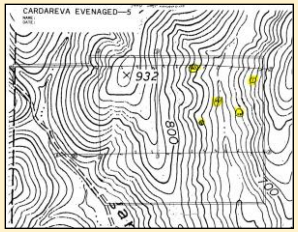
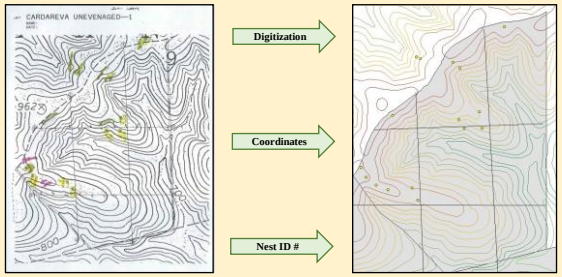


Figure 3 and 4: Raw data collection sheets used field technicians to record nest locations in 1994.

Methods

Using ArcGIS mapping software, I was able to digitize almost 20 years of nest location data for analysis. This process required the development of automated workflows within ArcGIS as well as careful interpretation of the raw data physically recorded throughout the years. Because data in ArcMap is primarily in layers, I had to create a data entry layer in order to manually digitize the nest locations. Then for each nest I plotted the location within ArcMap using the raw data maps for reference.



Once locational data for a nest is digitized it still needs to be linked with the recorded observational data such as species, date, stage of nest, number of eggs and offspring, parasite presence, etc…
This is accomplished using an automated model that joins the data entry layer to the record table and transfers coordinates over before generating a new nest layer that contains all necessary information.

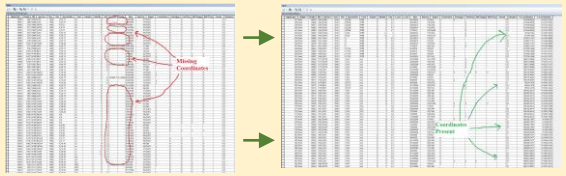
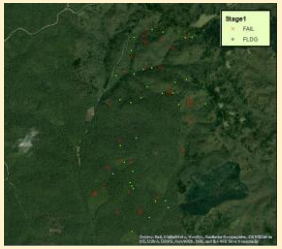


Figure 5: The Nest_builder model creates a new colum to combine the coordinate data From existing nests and digitized ones

The output of this nest building model is a layer that contains all current and previously digitized nests and data. From here it is possible to use this data for spatial analysis.

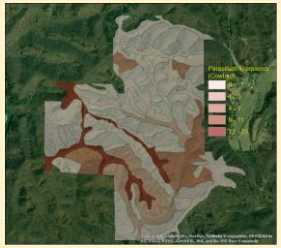
Results

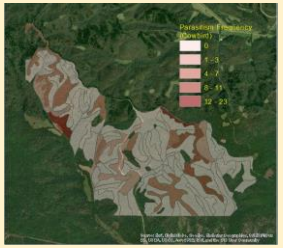
Ten focal species were selected for the interior bird's study, five mature-forest birds and five early-successional birds. These species are designated using alpha codes. Using the combined nests layer over 3,000 nests and 11,000 observations can be analyzed spatially and/or statistically for research proposes.



Figures 7 and 8 (Above): These two maps show Acadian Flycatcher nests that either failed or successfully fledged. This is denoted by a green dot for a successful nest and a red X for failed nests. The map on the right shows a much more surviving nests in its study area than the one on the left.

Figures 9,10,11 (Below): These three maps show the frequency of cowbird activity in the stand's nests. Cowbirds display parasitic behaviors by laying eggs in other bird specie's nests, as well as by destroying host eggs and killing host young. They do this to deceive the host parents into naturing their own young If you look carefully, you will see that cowbirds are more active near trails and less densely wooded stands than in the deep forest.





Mature Forrest

AFCL	Acadian Flycatcher
OVEN	Ovenbird
WEWA	Worm-eating Warbler
WOTH	Wood Thrush
KEWA	Kentucky Warbler

Early Successional

INBU	Indigo Bunting
YBCH	Yellow-breasted Chat
HOWA	Hooded Warbler
WEVI	White-eyed Vireo

Acknowledgements and References

Acadian Flycatcher image from Google Images

Morris et al. (2013). Results of 20 years of experimental forest management on breeding birds in Ozark forests of Missouri, USA. Forest Ecology and Management. 310. 747-760.

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