

Abstract:

The habitat diversity hypothesis suggests that larger habitat islands support more species because more habitats are present in larger areas. The Saint Michael's Natural Area is an island of natural habitat in a suburban matrix that supports 171 bird species and ranks 13 out of 100 Chittenden County Natural Areas according to eBird records. If habitat diversity explains this richness, then we should expect species turnover between various habitat types within the bounds of the site. Therefore, we chose to study bird species diversity in the Natural Area at three different sites. These sites were as follows: recovering open fields, upland forest, and sandplain forests. In both the upland forest and the sandplain forest we installed seven nest boxes suitable for cavity-nesting species and in the open field we placed six. The bird boxes served as focal points for one-hour bird observation periods, and we recorded all bird species seen within fixed ranges of the boxes. A total of seventeen observations were made per site over an 8-week period in summer 2021. Of the three habitats observed, the recovering agricultural fields had the greatest species richness with a total of twenty-four species being observed. The other two ecosystems were quite rich, with both the sandplain and upland forests having eighteen species. With an average of six species, the open field had the greatest average number of species spotted per day. In both forest ecosystems the average number of observed species was four per day. The numbers of bird species observed in one habitat only was ten, three, and two in field, sandplain, and upland respectively. Overall, we observed a total of thirty-three species. These patterns of species unique to specific habitats contributing to the overall Natural Area richness is consistent with the habitat diversity hypothesis. Studies of this nature can inform conservation decisions and further the goal of supporting diverse bird communities by preserving essential habitats.

Background:

- Birds are an integral part of forest and field ecosystems as they eat both bugs and plants and are food sources for many higher-level predators.
- Human impacts can greatly affect bird species abundance and variety in these ecosystems and these populations can be used to assess the overall health of these ecosystems.
- The clear cutting of forests in New England during the 19th century dramatically changed Vermont's landscape from forests to open fields, but since the 20th century the forests have returned (Askins 2002).
- Its important that we observe these recovering ecosystems as they could tell us a lot about the natural history of Vermont.
- The Saint Michael's natural area provides a perfect place to observe this phenomenon as it already has several recovered forests but also former farmland that is being converted back to forest.
- The objective of this study was to observe these birds in these three ecosystems to get an accurate record of the species abundance and richness of these three ecosystems.

Methods:

- Seven bird boxes were installed in both the sandplain and upland forests. Six were installed in the open field.
- The bird observations were done in the Saint Michael's natural area during the summer of 2021 in 3 different ecosystems. They were upland forest by wetlands, sandplain forest, and recovering farmland field.
- The observations were done in the mornings with an hour of observation at each site. The order in which each site was observed was changed each day to ensure variety.
- The number of birds spotted was recorded along with species name, weather, start time of observation and duration of observation.
- We examined the relation between the total abundance per half hour sample against the species richness in each ecosystem. The number of unique species in each ecosystem was also examined.

The effect of ecosystem diversity on bird species richness and abundance

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Results:

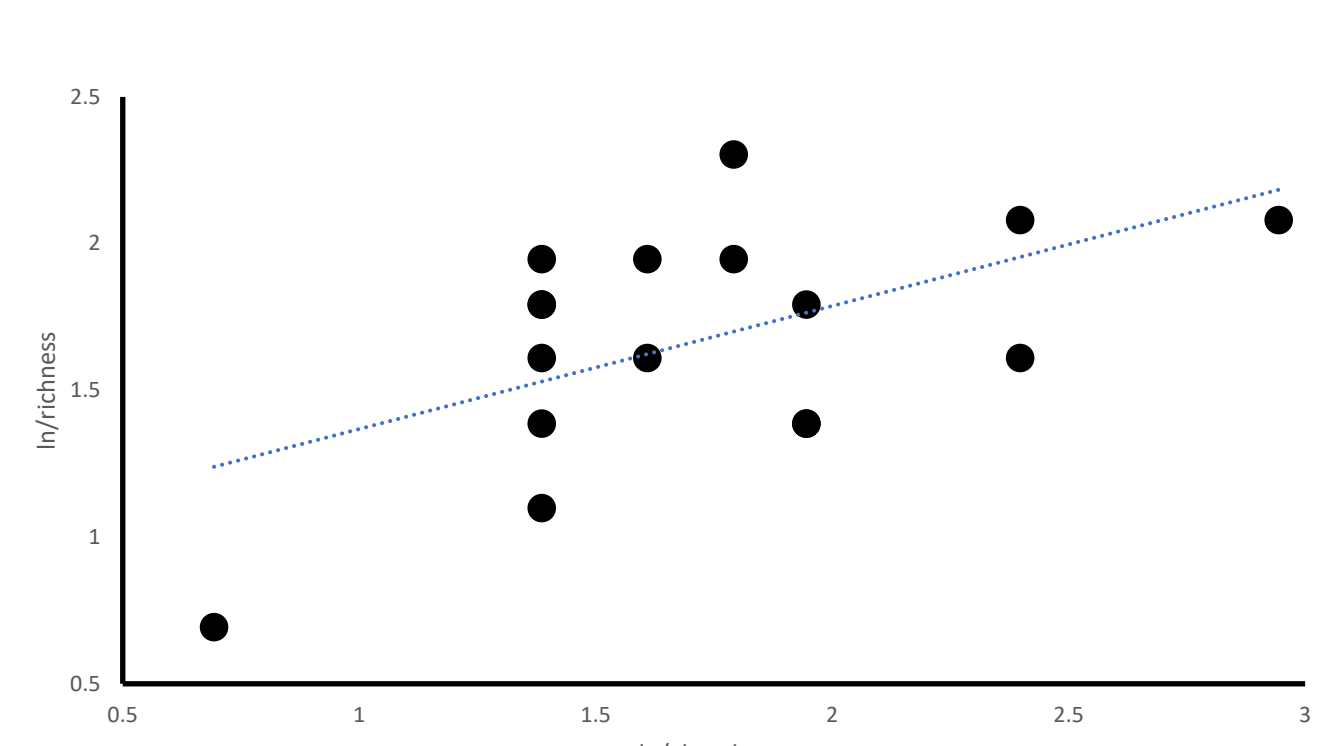


Figure 1: The total abundance per half hour sample against the species richness found in the open field ecosystem. The data were collected over a period of seventeen days with total abundance representing number of birds seen per 30-minute observation period.

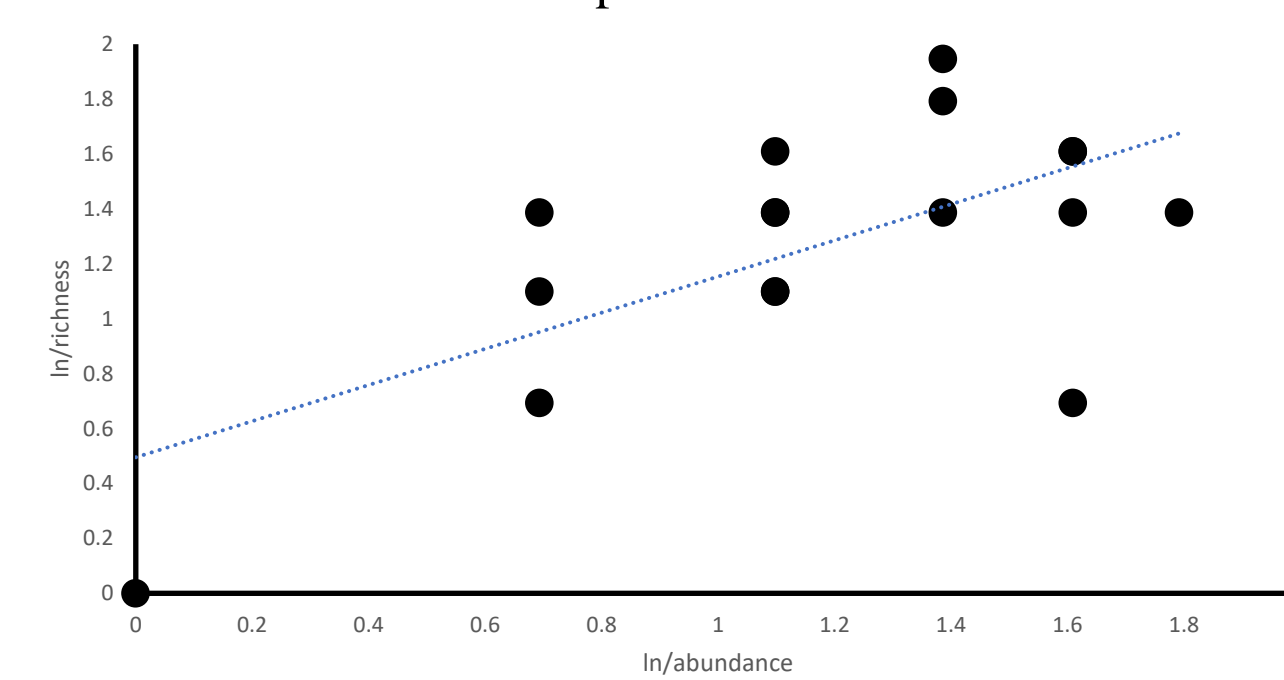


Figure 3: The total abundance per half hour sample against the species richness found in the upland forest ecosystem. The data were collected over a period of seventeen days with total abundance representing number of birds seen per 30-minute observation period.

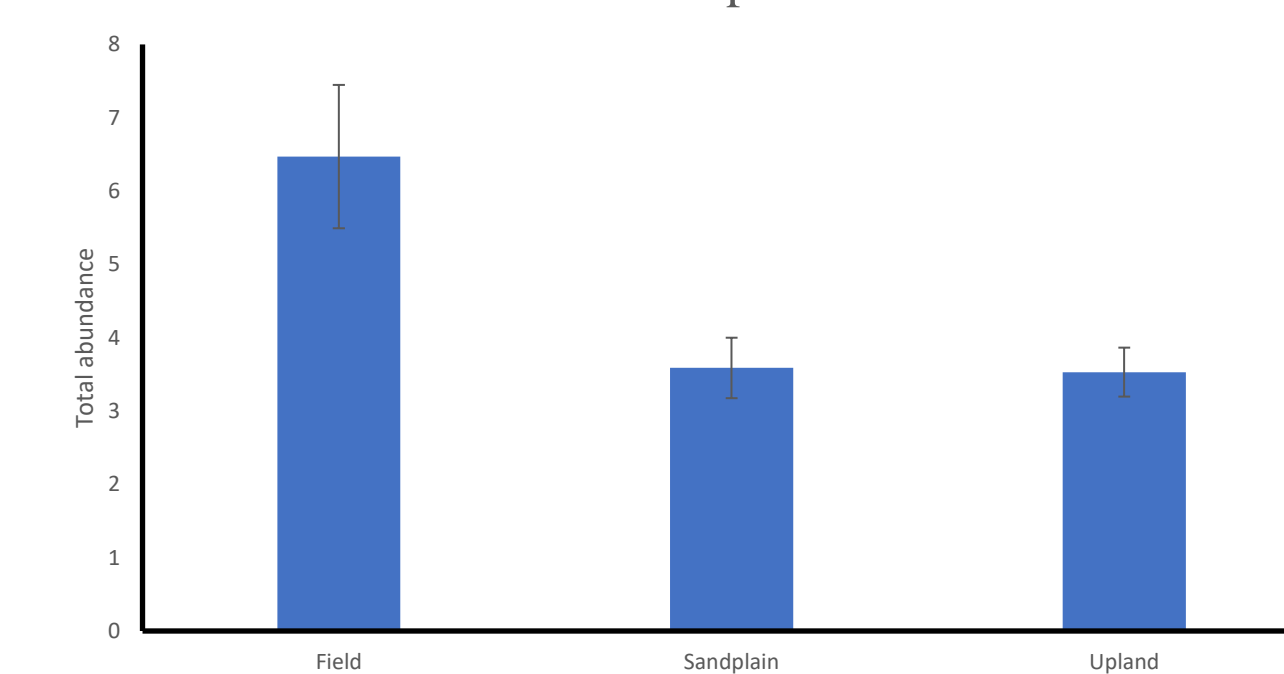


Figure 5: The average total abundance of each site taken over a period of 17 observation.

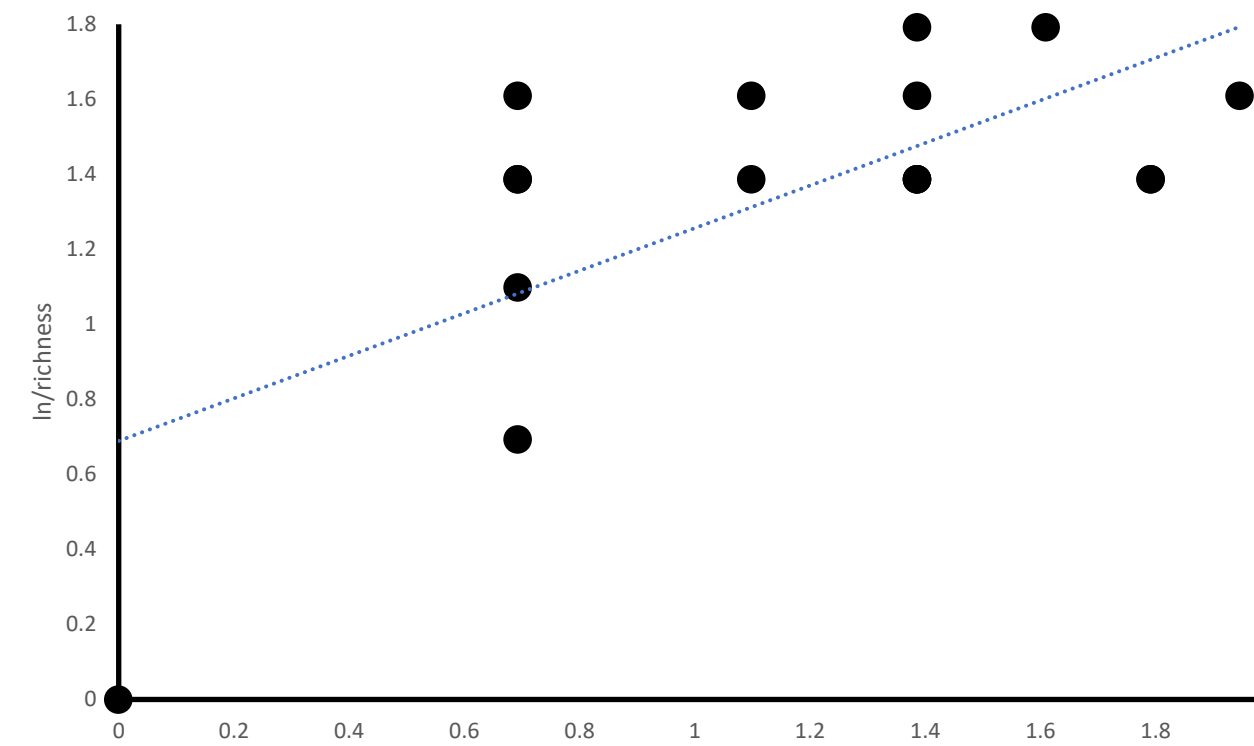


Figure 2: The total abundance per half hour sample against the species richness found in the sandplain ecosystem. The data were collected over a period of seventeen days with total abundance representing number of birds seen per 30-minute observation period.

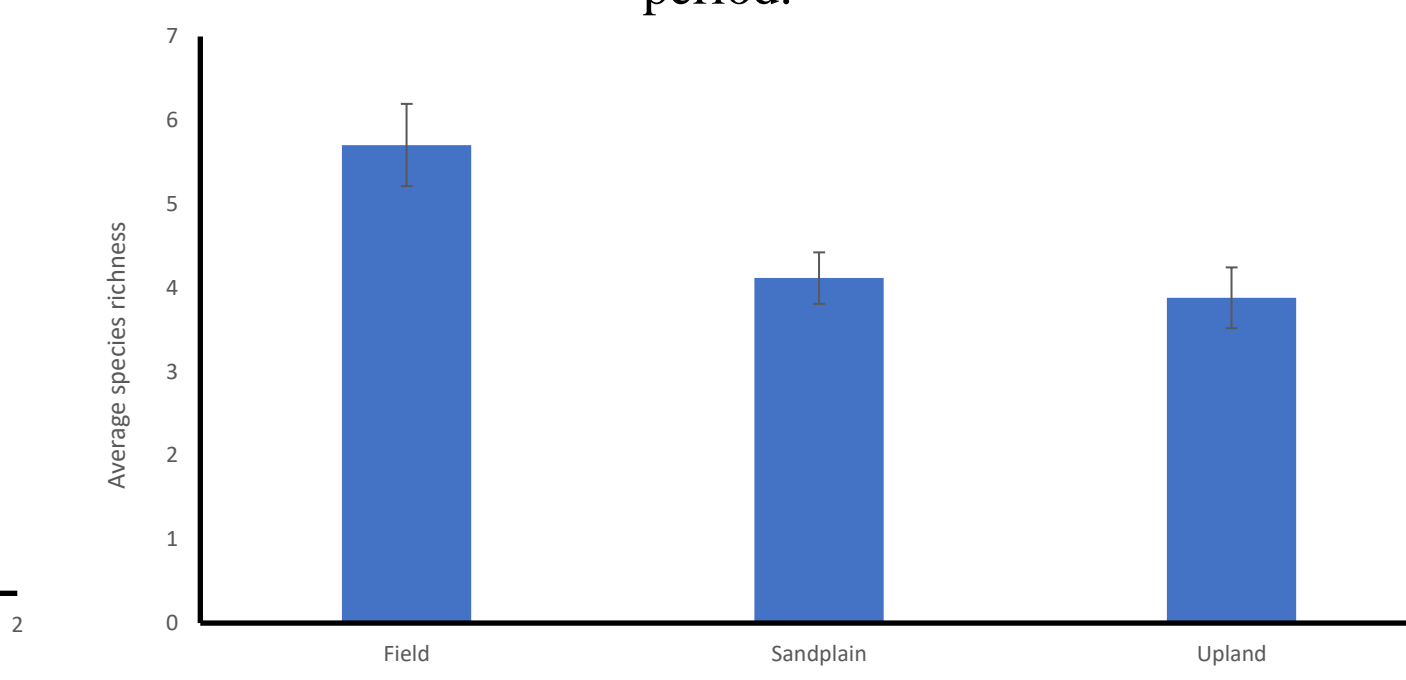


Figure 4: The average species richness of each site taken over a period of 17 observations.

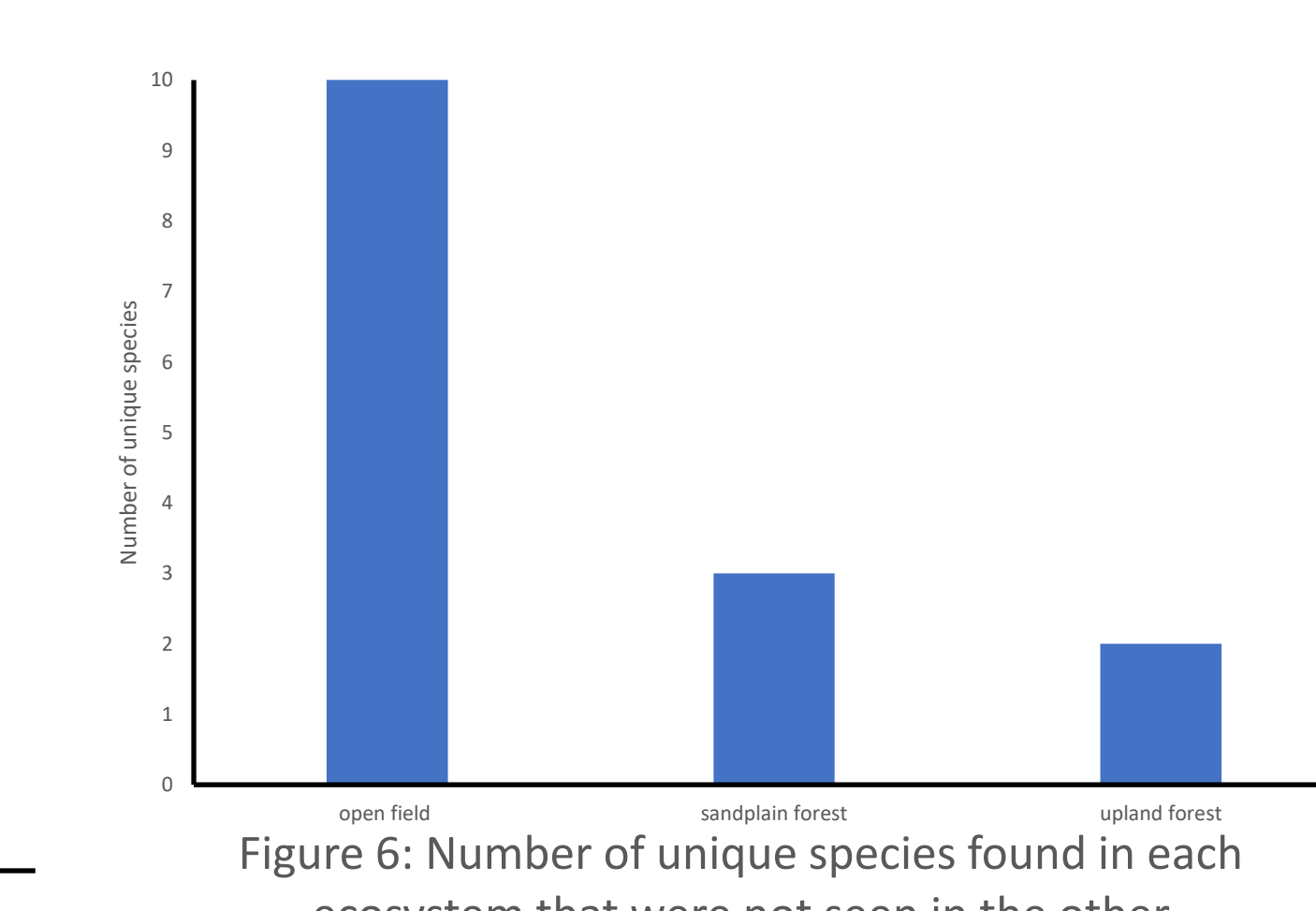
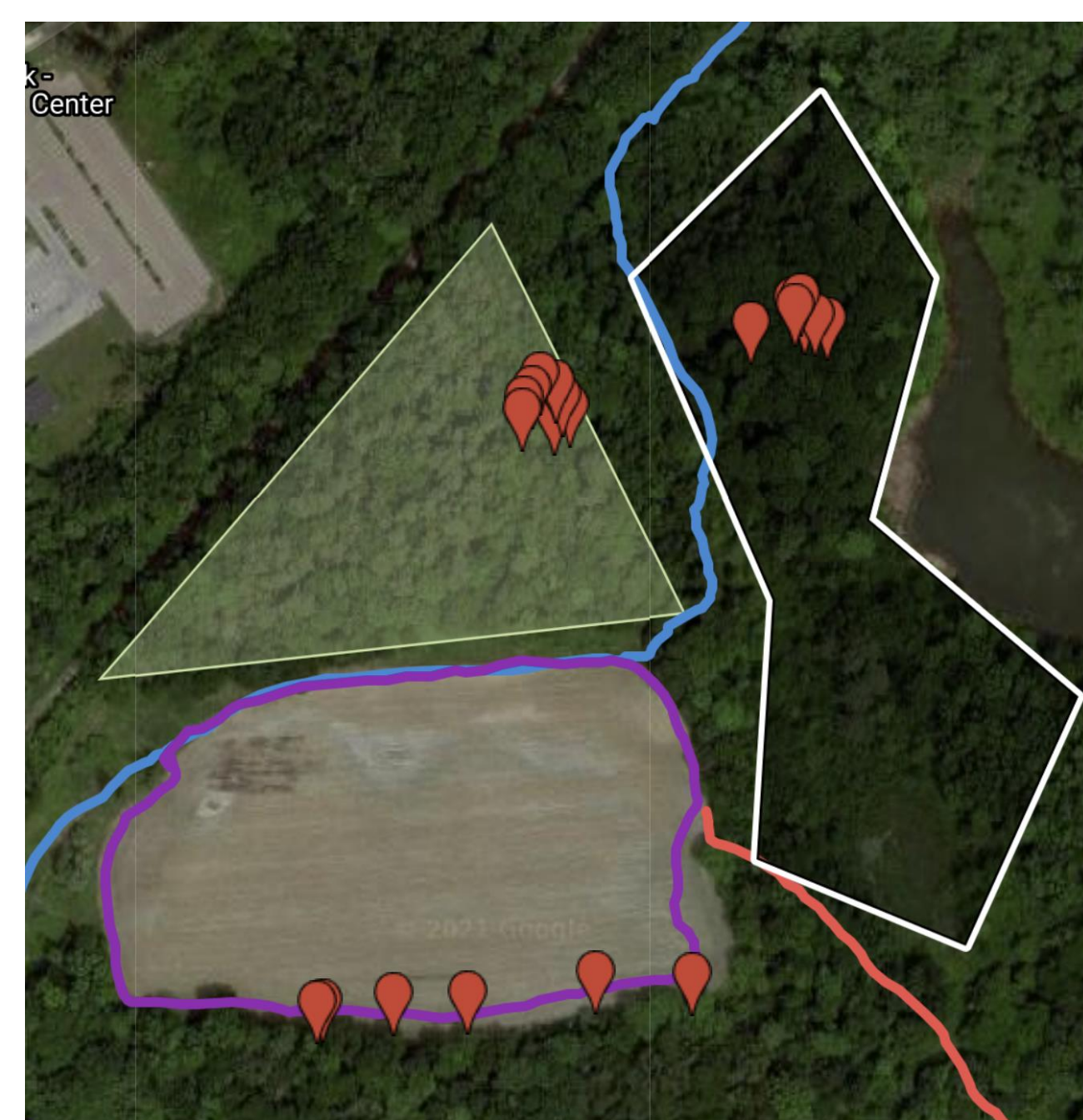


Figure 6: Number of unique species found in each ecosystem that were not seen in the other ecosystems.



Map of the natural area



Male Indigo Bunting feeding

Discussion:

Ecosystem variability was found to have a significant effect on species richness and abundance, which is in line with the habitat diversity hypothesis. Many bird species appear in all ecosystems observed which means they are well adapted to a plethora of ecosystems. The ones that only appear in the recovering farmland open field habitat are the ones that could be in trouble as it contains 10 unique species that were not found elsewhere. If the forest continues to encroach it could affect the bird populations in these areas as vegetation variety are strongly associated with bird populations, which is line with other studies (Buchanan, M. L., Askins, R. A., & Jones, C. C. 2016). This also applies to the sandplain and upland sites as they have markedly different vegetation types.

The open field site had both the highest average species richness and average total abundance of birds spotted (Figures 4 & 5). The open field site also had the highest number of unique species spotted with 10 bird species being unique to the field habitat (Figure 6). This trend can largely be attributed to the fact that in an open field there are less obstructions to view which means that birds can be more easily spotted. However, in the two forest ecosystems average species richness and average total abundance was lower than that of the open field sites. It is certain that in these ecosystems many birds went unspotted as the canopy of these sites hid them from view. Often the only sign that a bird was present was its call but that's not always guaranteed. In the sandplain forest the average species richness was slightly higher which could be attributed to its more open canopy. In terms of unique species spotted there was a lot of overlap between the sandplain and upland forests species. This is likely because they are both forests, and as such they would contain similar species. The open field site had the highest species richness overall but the total abundance per half hour was much lower than expected (Figure 1). This could be attributed to the fact that birds would often come to the edge of forests but not venture too far out into field. Furthermore, many birds remained out of view hidden in the weeds of the field. The upland and sandplain forests tended to be towards the lower end in both total abundance and richness, but that is be expected (Figures 2 and 3).

Work Cited:

- Askins, R. A., & Margaret J. Philbrick. (1987). Effect of Changes in Regional Forest Abundance on the Decline and Recovery of a Forest Bird Community. *The Wilson Bulletin*, 99(1), 7–21.
- Askins, R. (2002). *Restoring North America's Birds : Lessons From Landscape Ecology: Vol. 2nd ed.* Yale University Press.
- Buchanan, M. L., Askins, R. A., & Jones, C. C. (2016). Response of bird populations to long-term changes in local vegetation and regional forest cover. *The Wilson Journal of Ornithology*, 128(4), 704.

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