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Assignment 1: Landscape Ecology and GIS

INTRODUCTION

With the consideration of preserving and enriching biodiversity in fragmented landscapes, debates have arisen on the influence of habitat connectivity in comparison to area. Previous studies in this field have produced mix evidence. So, given the gap in knowledge, Thiele *et al.* (2018) sought to determine whether habitat area or habitat connectivity played a greater role in plant species richness. They predicted that linear connectivity would have a more positive effect on species richness, and took into account that connectivity of an area may be correlated with area and that different species had diverse habitat preferences and dispersal patterns. Their investigation is specifically of "the relative importance of connectivity and area for plant species richness of open linear landscape elements (LLE) in intensively used agricultural landscapes" (Thiele *et al.*, 2018, p. 2).

METHODOLOGY

The study took place in the low-land agricultural region of Münsterland in Northwest Germany, and involved field sampling, GIS analysis, and statistical analysis. Eight quadratic study areas sized at one kilometer^2 were randomly selected using geospatial modeling environment (GME) in ArcGIS 10. Woodlands, settlements or large bodies of water were excluded from the sampling; as well as areas of uncommon soil conditions or terrain. In these study areas, five to eight plots were established on open LLE with a minimum distance of 100 meters between them. A total of 50 plots that were each 25 meters^2, and situated within LLE such as field margins and ditches (Thiele *et al.*, 2018, p.1), were established in each of the study areas for sampling. The plants were classified into ecological groups and dispersal distance classes before the species richness of the sampling plots were calculated.

Using GIS for analysis, the LLE were mapped from aerial photographs with 40-centimeter spatial resolution in order to assess area and connectivity. A circular buffer of 500 meters was placed around the center points of the plots, within in which the resistance distance (Thiele *et al.*, 2018, p.1), based on circuit theory, was

used as a measure of connectivity of LLE. Then, the vector layers that resulted were converted into raster datasets with a one-meter resolution. These were then used to calculate the resistance distance of LLE within the buffers around the sampling plots using Circuitscape. A negative effect of resistance distance of LLE between plots in this analysis is actually a positive effect of connectivity of LLE on species richness. The effects of area and connectivity on species richness was also modelled with multiple generalized linear mixed models (GLMM) in R. And they also tested for spatial auto-correlation of the residuals using Moran's I.

CONCLUSION

The results showed that connectivity is more important than area for species richness in LLE, especially for plant species that are confined to semi-natural habitats. This shows that connectivity effects are group specific rather than universal to all plants. Species richness did not increase with area, but rather had a negative effect in some cases. The positive effect of connectivity is suspected to be attributed to increased dispersal activity due to higher connections in the LLE network and quicker accumulation of species on plots. This means that the density of continuous connections serves as an important function of habitat corridors to improve local species richness. These findings are crucial as more and more land in these areas are converted into agricultural land use and native plant habitats become increasingly fragmented.

Along with its findings, this paper shines light onto the use of GIS, coupled with field sampling and statistical analysis, in landscape ecology and the examination of diversity patterns. This paper extends the discussion to include the importance of its findings in land use planning, landscape design, agro-environment schemes, and climate action efforts such as green infrastructure, by stating that conserving present LLEs and adding additional narrow LLEs will provide the greatest sustainability of plant species both locally and regionally (Thiele *et al.*, 2018, p. 8). Therefore, this paper conveys that GIS analysis is crucial, and much more information can be inferred through GIS analysis than the map itself. The same set of results can be used in a multitude of fields. For this reason, and because the paper provided thorough explanations of its argument, procedure, and results in both technical and non-technical manners, it earns a rating of 10.

References

Thiele, J., Kellner, S., Buchholz, S., & Schirmel, J. (2018). Connectivity or area: what drives plant species richness in habitat corridors? *Landscape Ecology*, 1-9.