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GEOB 479

Assignment 1 Landscape Ecology and GIS-Paper Review

Bender, D. J., Tischendorf, L., & Fahrig, L. (2003). Using patch isolation metrics to predict animal movement in binary landscapes. *Landscape Ecology, 18*(1), 17-39. 10.1023/A:1022937226820

Authors Bender,Tischendorf and Fahrig addressed the research problem of the reliability of isolation metrics in relation to organism dispersal. Moreover, the aforementioned isolation metrics were then applied to distinct landscape scenarios in order to predict animal movement. Landscape scenarios were examined for two effects, respectively isolation and patch character, the latter referring to size and shape. In addition, landscapes were mapped through four methods. These methods were: point pattern, binary, mosaic, and raster image. Though each method was distinct, there were shared commonalities. Both the point pattern and binary methods had the patches existing in a homogeneous matrix, with the distinction of point pattern patches all being the same size while binary patches were able to be contrasting sizes and shapes. Furthermore, mosaic and raster images were both classified by more than one land type. This was in contrast to point pattern and binary which were distinguished by only one land type i.e. land and non-land. Mosaic and raster landscapes did still have dissimilarities, with mosaic being discrete land types while raster images were based off of scanned photographs and as such their landscape characterization worked on a gradient.(Bender Tischendorf & Fagrif,2001)

In order to analyze the effects of isolation, four metrics were examined using GIS. The metrics were then placed into two groups belonging to either distance-based or area-based. Distance-based metrics included nearest-neighbor distance and voroni polygon area, while area-based metrics included buffer area and proximity index. As noted by the authors “it is difficult to evaluate patch isolation metrics empirically because there is an incredible paucity of movement data available in the literature”(Bender et al.,2001, p.5) Therefore in order to avoid the issues of the variability of animal movement and dispersion the study instead used simulation data. This allowed for simpler replication and the avoidance of confounding factors such as dispersal related mortality (Bender et al., 2001).

The authors found that in realistic landscapes I.e. the ones created through raster data, patch size and shape characteristics were responsible for approximately 50% of patch immigration rate. Additionally squared correlation coefficients were smaller in the realistic landscapes due to the influence of patch size and shape. Moreover, the authors noted that area-based metrics outperformed distance-based metrics in both landscape scenarios. This was likely due to the fact that distance-based metrics were unable to account for proximate habitat, whereas area-based metrics excelled in this regard.

The methodology used throughout this paper appeared well rounded and was applicable to the question of study. As it was repeatedly noted that the interest of this study was specifically how “spatial isolation alone affects movement and how this relation can be appropriately measured” (Bender et al., 2001, p6). With that considered it then seems pertinent to only focus upon area and distance metrics in simplified landscapes. Additionally the use of the four GIS metrics meant that most people familiar with GIS should at least understand the basics, as the metrics chosen are commonly used. Conversely, this paper did appear to have deficiencies in the methods used for movement. The choice to use simulation data with simple decision making abilities meant that the species dispersal abilities were dissimilar to the actual abilities of most real species. This simplicity can be noted in the ability of an animal to only move 5 pixels at a time in any 360**°** direction per a time period (Bender et al.,2001). Moreover, the importance of patch size would likely decrease in a more intelligent simulation with isolation becoming a more important determinant of immigration. Furthermore, the edges in the simulation as well received a disproportionate amount of immigration, which in a natural system would likely never occur due to sub optimal habitat which often occurs around the edges of any landscape. In conclusion the authors represented their argument and research goal very well in this paper. Though it can be argued that they chose to ignore some of the more complex attributes of immigration that as well was not within the scope of their experiment. Therefore this paper should receive an 8 out of 10 for its application of simple metrics to a complex problem.