Using a Windbreak Habitat Model Across Broad Landscapes: The Effect of Local Landscape Composition and Geographic Location

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1. Windbreaks as Habitat

Agricultural lands — fields, pastures, and orchards — are managed to produce food and fiber for people. In the U.S. Great Plains, an extensive agricultural landscape; windbreaks have been planted to protect fields, crops, livestock, and farmland from the prevailing winds. Windbreaks provide some of the scarce wooded habitat for birds and other wildlife that people have come to value. Windbreaks make up about 25% of the wooded cover in Nebraska, much of the other wooded cover occurs along riparian corridors.

Although they protect soil from wind erosion and provide habitat for some species, windbreaks also contribute to the fragmentation of prairie grasslands. Prairie fragmentation negatively impacts grassland wildlife such as greater prairie chickens, upland sandpipers, and pronghorn antelope.

2. Regional Evaluation of Windbreaks

The Environmental Monitoring and Assessment Program’s Agricultural Lands Group — charged with assessing the ecological condition of U.S. agricultural lands — undertook a pilot study to evaluate the habitat value of windbreaks on a regional basis. We decided to use a bird species richness index to measure the habitat value of individual windbreaks.

We selected a random sample of 60 windbreaks in Nebraska, based on a screening question on a USDA National Agricultural Statistics Service agricultural survey. In July 1994, field crews measured attributes of 40 windbreaks (one third of the farmers refused to participate). The data were used to estimate the value of windbreaks as breeding bird habitat in Nebraska.

3. Bird Species Richness Index

We used the U.S. Fish and Wildlife Service’s Bird Species Richness Index (BSRI), which estimates the number of breeding bird species a single windbreak can support based on four windbreak attributes.

- Area has the greatest impact on bird diversity; larger windbreaks support more species.
- Area was measured by calibrated pacing.
- Height: Taller windbreaks provide more niches. Height was measured by photographic analysis.
- Vertical Structure: A more structurally complex windbreak provides more habitat niches; measured by point sampling.
- Snags: provide another habitat niche. Snags were censused.

4. Validating BSRI Model

In 1995, a team of five ornithologists revisited 35 of the 40 windbreaks (5 farmers refused further visits) between late May and early July.

Each windbreak was visited four times. Data were collected between one-half hour before and four hours after sunrise.

All observed birds were identified to species and recorded using spot mapping techniques. Tape recorded vocalizations of the eastern screech-owl were played on the final pass through the windbreak for each visit. Because the windbreaks were narrow, we assumed all species were detected.

5. Results of Validation

The model overestimates the number of bird species in the Nebraska windbreaks (graph left). However, the relative qualitative ranking of windbreaks is generally preserved. A total of 51 species were observed.

No strong, significant relationship was found between deviation of observed from predicted number of species and any windbreak attribute or the geographic location of individual windbreaks.

Forest-interior, area-sensitive, and forest-edge species occurred in the larger, taller, more complex windbreaks.

Open-field and grassland species occurred in the smaller, shorter, less complex windbreaks.

6. Failure of the Model

There are several possible explanations for the failure of the model to predict accurately the number of bird species in the windbreaks:

1. Geographic differences in species richness. The model was developed in Kansas, which has 5-20 more species of birds than Nebraska (Breeding Bird Survey’s species richness map of North America).
2. Dependence on different windbreak characteristics. The number of species in Nebraska’s windbreaks depends differently on windbreak characteristics than did the number of species in Kansas.
3. Dependence on landscape-scale characteristics. The number of species in Nebraska’s windbreaks depends on characteristics of the surrounding landscape.

7. Local Landscape-Scale Effects

Land cover data were collected for the quarter-section (160 acres, 65 ha) containing the sample windbreak. Cover categories were trees, woodland, crop, grass / herbaceous, barren / non-vegetated, and water. Fences and cattle grazing were also recorded (present / absent).

Landscape metrics computed included relative cover distributions, total edge length, edge / area ratios, number of patches, mean patch size, mean perimeter per patch, and size of largest field.

The deviation between observed and predicted number of species was not significantly related to any of the landscape metrics. This suggests that within a region the number of species using a windbreak depends primarily on windbreak attributes.

8. Conclusions

1) The Bird Species Richness Index for windbreaks cannot be extended simply to describe species richness at large regional scales without either re-calibrating regionally or adding terms that account for differences in regional species pools.
2) Local landscape-scale composition and structure do not explain the failure of the model.
3) The presence of species guilds in windbreaks (e.g., forest interior, grassland) may be explained by windbreak size and complexity. The model may be more useful for predicting the presence or absence of species guilds than for predicting the total number of species present.

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