Submitted for Poster Session

THE EFFECTS OF FOREST FRAGMENTATION ON FOREST INTERIOR BIRD SPECIES DIVERSITY ON A COASTAL WATERSHED LANDSCAPE

CHRISTINA BRINSTER, AMANDA SPEARS, JESSICA WHITE
Centreville Middle School, Centreville, Maryland U.S.A.

Preston, Darlington, and others have shown a clear relationship between the area (A) of oceanic islands and the number of species (S) they contain, $S=CA^z$, where C is a constant dependent on fauna and island location and, for birds and many other organisms, $z \approx 0.3$. Wilson and MacArthur's Island Biogeography Theory further predicts that the actual species composition on an island will change from year to year under a stable equilibrium caused by equal immigration and local extinction rates (species turnover). Forest fragmentation creates forest "islands" of different sizes on the mainland, each surrounded by other land uses such as agriculture or development. We have investigated forest "islands" on the Maryland Eastern Shore of Chesapeake Bay to see if the species-area relationships described for oceanic islands can be applied to forested habitats on a coastal watershed.

We used global positioning system (GPS) units to determine the area and then to navigate through a geo-referenced series census points through each of 5 forest "islands ranging in size from 1.4 hectares (Chino Farms Haint Woods) to 57.2 hectares (Andelot Farms Big Woods). We found a significant correlation ($r = 0.94$, $n = 11$, $P< .0001$) between island area and the number of species found with $z = 0.28$. The data clearly show that larger forest "islands" have more species and that this relationship is consistent with the species-area equation for oceanic islands.

We also estimated annual species turnover (T) for two "islands" (Haint Woods and Big Woods) which had been sampled the previous year (2004). As each island was censused twice in 2005, we could also estimate the replication error (RE) for repeated censuses in the same year. Annual species turnover and replication error were almost identical for both forest areas (Haint Woods, T = 59%, RE = 60%; Andelot Farms, T = 24%; RE = 17%). There is no evidence for any significant species turnover separate from replication error.

We further examined the turnover problem by looking at actual species' composition on an additional 55 forest "islands" informally surveyed in 2005. We found that certain species, such as Black-and-white Warbler (*Mniotilta varia)* and Worm-eating Warbler (*Helmitheros vermivorus),* were rarely, if at all, found in small forest "islands." The inability of such area-sensitive species to successfully colonize the smaller "islands" suggests that factors other than random extinction and immigration may be in operation on these mainland "islands." These results, plus our inability to demonstrate significant species turnover separate from replication error, are not consistent with Wilson and MacArthur island biogeographic theory.

We conclude that the oceanic island species-area relationship, $S=CA^z$, also applies to forest "islands" on the mainland. However, species turnover, a critical component of Wilson and MacArthur island biographic theory, cannot be demonstrated. Area sensitive species tend to drop out as forest "island" size decreases, and the smaller "islands" are populated predominantly by species that require less specialized habitat. These species may not even be breeding in the smaller forest "islands" censuses, contributing to a larger replication error as birds come and go between censuses. Our data suggest that management of land in coastal watersheds should focus on preserving the largest forest blocks possible to maintain the largest bird species diversity. Landscape designs that are intended to promote the migration of bird species between such "islands," such as biocorridors, may fail to increase species diversity if the "islands" are not large enough to accommodate area-sensitive species.