

Annotated Bibliography: Forest Fragmentation effects on birds
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Biology 862-Ecology Seminar (Plant-Animal Interactions)

Sekercioglu CH, et al. (2002) **Disappearance of insectivorous birds from tropical forest fragments.** Proceedings of the National Academy of Sciences **99**: 263-267

This paper attempted to determine the cause of the decline of insectivorous bird populations in forest fragments. Four hypotheses were proposed to explain this decline: the food scarcity hypothesis (lack of prey in fragments), the microclimate hypothesis (these birds are highly sensitive to slight changes in climate due to fragmentation), the habitat specificity hypothesis (the loss of plants and other factors which influence insect populations), and the limited dispersal hypothesis (insectivores will only remain in their fragment which will cause decline due to stochasticity.) The authors tested the food scarcity hypothesis by examining the stomach contents of insectivores in large and small forest fragments and determined that there was no statistical difference between the two groups. They conclude that the limited dispersal hypothesis is best represented by their study, as birds that did not use multiple fragments experienced the most decline.

Hansbauer MM, et al. (2008) **Comparative range use by three Atlantic Forest understorey bird species in relation to forest fragmentation.** Journal of Tropical Ecology **24**: 291-299

*This study radio tracked 55 individual birds from three species in fragmented and continuous forest to elucidate if they were expanding their home ranges in response to fragmentation. The three species represented different sensitivities to human disturbance (as determined by a previous study) and included one frugivorous species and two insectivorous species. One species, *Chiroxiphia caudata* (Blue Manakin), utilized home ranges twice as large in the fragmented forest, while *Pyriglena leucoptera* (white-shouldered fire eye) and *Sclerurus scansor* (rufous-breasted leaf-tosser) did not show any significant difference in home range size. The authors conclude that certain species may have the ability to expand their home ranges and will do so, while those that are not able may be particularly sensitive to fragmentation.*

Wiens JA (2004) **Habitat Fragmentation: island v landscape perspectives on bird conservation.** Ibis **137**: S97-S104

In this paper, Wiens argues against the MacArthur/Wilson model of fragments as islands, surrounded by inhospitable environments. Instead of an ecologically neutral or negative space he describes the areas surrounding fragments as a "disruption of habitat continuity." He also takes issue with the blind assumption that ecological corridors are positive and instead says that the focus should be on landscape connectivity or "networking." To fully understand this, however, habitat selection of the species under study must be taken into account. He concludes with the idea that conservation shouldn't be focused solely on reserves and that landscape mosaics need to be considered as well.

Grubb TC, et al. (1999) **On home-range gap-crossing.** *The Auk* **116**: 618-628

This article studied the interactions of four factors in metapopulation dynamics: area dynamics, specialized habitat requirements, edge effects, and gap crossing ability. They concluded that bird body size, proximity, time of year, and prevalence of woodlands had an effect on resistance to fragmentation.

Lees, AC and Peres CA (2006) **Rapid avifaunal collapse along the Amazonian deforestation frontier.** *Biological Conservation* **113**: 198-211

Lees and Peres looked at the combination effects of rapid habitat loss, deforestation, and disturbance on tropical birds in Brazil along an “arc of deforestation” in the southern Amazon. They sampled 21 patches of varying size and quality for population structure (including level of nestedness). They also looked at the species area relationship ($S=cA^z$) where S =# of species, A =area, and c and z are constants. Lees found that forest specialists were more affected by the habitat patch size and quality, and that the species area relationship seemed to be operating, especially with regard to the forest-patch geometry and habitat quality surrounding the patch. The community was also highly nested which implies that fragmentation affects species based on life history characteristics.

Debinski DM and Holt RD (2000) **A Survey and Overview of Habitat Fragmentation Experiments.** *Conservation Biology* **14**: 342-355

In this literature review, Debinski and Holt looked at studies that have done habitat fragmentation experiments. They found that the experiments with insects had fairly reproducible results while the studies with mammals and birds were highly variable. Only 6 of the 20 experiments showed that species richness was a function of island size or isolation. This paper delves into many topics such as edge effects, landscape connectivity, and issues with temporal time scales. They find that, in general, when fragmentation first occurs there is a “crowding effect” but this gradually leads to an overall decline in population, a result that would not be clear in a short term study.

Sekercioglu CH and Sodhi NS (2007) **Conservation Biology: Predicting Birds' Responses to Forest Fragmentation** *Current Biology* **17**: R838-R840

This short review discusses a number of papers regarding fragmentation effects on birds. It begins by explaining that this effect can differ based on the ecological traits of a particular species such as body size, diet, mobility, and degree of specialization. The species-area relationship is discussed and the author states that the predictive rate of the model is weak but it is the currently the only existing model. The paper goes on to discuss nestedness where a higher level of nestedness correlates with more organized populations, typical of specialized and sedentary species which are also more extinction prone. Overall, this review concludes that there is no concrete way to predict how a species or population will respond to fragmentation and suggests the need for a global meta-analysis.

Atauri JA and de Lucio JV (2001) **The role of landscape structure in species richness distribution of birds, amphibians, reptiles, and lepidopternas in Mediterranean landscapes.** *Landscape Ecology* **16**: 147-159

Atauri and de Lucio present findings in this paper that landscape heterogeneity is the most important factor for determining species richness, even more important than the specific composition of the land use. They use species atlases from the area with landscape structure indexes to calculate species richness. Their conclusion is not surprising, as it is obvious that different birds will use different habitats optimally, though they caution against using this finding to advocate habitat destruction (even if it is to diversify habitats) and say that the requirements of sensitive species should be taken into account. The ultimate conclusion is that is not necessary to return areas to natural areas, that a mixture of farms and reserves can yield effective management.

Selwood K, Mac Nally R, Thomson JR (2009) **Native bird breeding in a chronosequence of revegetated sites.** *Conservation Ecology*. **159**: 435-446

This paper tries to determine how habitat and site characteristics in revegetated sites affect bird breeding. Selwood et al. used MacNally's method to establish the suitability for breeding in previously degraded patches that had been re-vegetated 9-11 years ago. MacNally's method looks at the range of the site, the landscape surrounding it, and the habitat characteristics. The sites were small, mostly under 10 ha. Bird surveys were done to ascertain which species were present and 25 top ornithologists gave rankings to behaviors that displayed breeding success. These results, combined with vegetation analysis showed that in-site landscape characteristics were the most important factor in determining breeding success, especially fallen timber, species rich plant assembly, and abundance of mature trees. Grazing status was negatively correlated with breeding success, though a previous study found otherwise. Most likely grazing affects birds differently, depending on their life history. I found this article very powerful, but agree with the authors that the small sites, time period limitations, and non-uniformity of the planting sites may make the findings less relevant.

Daily GC, Erlich PR, and Sanchez-Azofeifa, GA (2001) **Countryside Biogeography: Use of human-dominated habitats by the avifauna of southern Costa Rica** *Ecological Applications* **11(1)**: 1-13

Countryside Biogeography is a study of the effects of diversity, conservation, and abundance on species in human-dominated landscapes. This paper tried to determine the extent to which a bird community was affected by agriculture in southern Costa Rica. The authors sought to compare species diversity in fragments and open habitats, assess the changes that have occurred in species make-up due to deforestation, and provide a

baseline for future studies. Daily used point counts for avifaunal diversity and Landsat technology to determine forest cover. They concluded that 55% of the species occurred only in forests and there was a strong species-area relationship for these fragments. Overall, most species were still abundant after 50 years of fragmentation which shows that these birds can use the fragments effectively, though any intensification in fragmentation could spell disaster for these forest-dependent birds.

Bennet, AF, Radford JQ, and Haslem A. Properties of land mosaics: Implications for nature conservation in agricultural environments *Biological Conservation* **133**: 250-264

Bennet, Radford, and Haslem use this article to review current literature regarding “whole” land mosaics. These papers study a land mosaic as a unit of replication, not just one fragment. There are not many papers that use this approach but based on these limited studies the authors state that heterogeneity of the mosaic is the strongest determinant for diversity with the composition of the mosaic and geographical location also playing large roles. This article was very dense, but was a good review of current literature and re-stated with stronger evidence the conclusions of other papers.

Yamaura Y, et al. (2008) Does land-use change affect biodiversity dynamics at a macro ecological scale? A case study of birds over the past 20 years in Japan. *Animal Conservation* **112**: 110-119

These authors utilize the “Living Planet Index” (LPI) along with national bird survey data to determine if fragmentation can be analyzed on a macro ecological scale. The LPI measures changes in biodiversity over time by measuring population trends in a year and comparing them, weighting all species equally. This study concluded that early successional birds were in decline and non-migratory forest birds were increasing. This is not a surprising result as former logging lands are regrowing and Japan gets most of its timber from Southeast Asia. Consequently, migratory birds that use land in Southeast Asia are in decline. This paper was very interesting, but I’m still fuzzy on the validity of the LPI and how they got rigorous range values for birds without radio telemetry.

Sekercioglu CH et al. (2007) Persistence of Forest Birds in the Costa Rican Agricultural Countryside *Conservation Biology* **21**: 482-494

In this paper, Sekercioglu, et al used radio tracking to establish which areas birds were using in agricultural habitats. They picked three species with different vulnerabilities to fragmentation and found that they were not commuting from forest fragments, rather they were using the agricultural habitat to forage and breed. However, their success depended largely on tree cover within the fragment as the birds spent 85%

of their time in 11% tree cover. The authors conclude that even modest increases in tree cover can have a large impact on the bird species that utilize deforested areas.

Haslem A and Bennet A (2008) **Countryside elements and the conservation of birds in agricultural environments** Agriculture, Ecosystems and Environment **125**: 191-203

This is another paper of Haslem and Bennet who look at landscape mosaics and how they affect different bird species. They used bird surveys to examine 27 different landscapes (1 km X 1 km) which varied from undisturbed to agricultural lands. They found that the most birds were found in areas with native vegetation but the farm landscapes still supported a number of species with more complex areas supporting more. The take home message of this paper is that native vegetation is the most important element in a patch, and increasing complexity aids in conservation.

Meyer CFJ, Kalko, EKV, Kerth G (2009) **Small-Scale Fragmentation Effects on Local Genetic Diversity in Two Phyllostomid Bats Different Dispersal Abilities in Panama** Biotropica **41(1)**: 95-102

Even though this paper focuses on bats, I felt that it was interesting and relevant to my study on birds and fragmentation because birds and bats share a similar set of problems in dealing with fragmentation. I also liked this paper because they ran genetic analyses, something I did not find in any of the bird papers. The authors sampled two bat species with differing dispersal rates in mainland Panama and from 11 different islands in Gatun Lake, Panama, that have been isolated from the mainland for 90 years due to the creation of a reservoir. They found that there was less genetic difference between the highly mobile bats while the less vagile bats seemed to be showing genetic isolation by distance caused by fragmentation. Though this is a very interesting result, it may not be applicable in countryside biogeography/land mosaics as many of the papers above show that birds do use farmland in varying ways.