

EDGE EFFECTS

Herps

Schlaepfer, M. A., and T. A. Gavin. 2001. Edge effects on lizards and frogs in tropical forest fragments. *Conservation Biology* **15**:1079-1090.

There are few papers on the effects of edge on herps. We reviewed this paper in class and generally agreed that the study methods were well conceived and admirably accomplished (especially so considering a death in the Schlaepfer family, see acknowledgements). The authors focused on 5 species of frogs and 2 of lizards that are commonly found on the forest floor. They found that only 2 species of frog were more abundant in the interior. They also noted a seasonal edge effect and in one species, found that ectoparasitism rates were lower on edges. The choice of taxa here is especially appropriate as small amphibians and reptiles are sensitive to variation in temperature and humidity and may be good indicators to the effects of wind throw and other abiotic manifestations of edges.

Birds

Laiolo, P., and A. Rolando. 2005. Forest bird diversity and ski-runs: a case of negative edge effect. *Animal Conservation* **7**:9-16.

Laiolo and Rolando conducted point counts throughout a region in the western Italian Alps and analysed their data using principal components analysis. Among their findings was that bird species richness and diversity are significantly lower in areas fragmented by ski runs compared to continuous forest. They hypothesize that the differences are due to differences in structure and resource availability. Their results and methodology are not especially interesting but they do come up with some management suggestions that may be helpful to ski-run landscapers concerned with avian diversity.

Lay, D. W. 1938. How valuable are woodland clearings to birdlife? *Wilson Bulletin* **50**:254-256.

This quaint article is relatively useless to the modern ecologist save for the glimpse it gives into the incipience of ecology as quantitative science. With language such as "afoot" and nary a scientific name for the birds listed, one must even forgive the passive voice for the charm of the article and lack of any statistic more complicated than an average.

Parker, T. H., B. M. Stansberry, C. D. Becker, and P. S. Gipson. 2005. Edge and area effects on the occurrence of migrant forest songbirds. *Conservation Biology* **19**:1157-1167.

This meta-analysis attempts to tease out the differences between edge effects and confounded area effects on neotropical migrants. They claim that all reported area effects are confounded by edge but that edge effects can be reported independent of area. The authors included 33 papers and found that edges only deterred one of 17 species, while 3 species showed a preference for edges. In the confounded area studies, 12 of 22 species avoided small patches, and 1 species showed a preference for diminutive habitats. To explain the differences, they cite that edge effect studies are carried out in areas with more forest cover, area effects are stronger than edge effects, and there may be area/edge interaction effects with decreasing size.

Sisk, T. D., N. M. Haddad, and P. R. Ehrlich. 1997. Bird assemblages in patchy woodlands: modeling the effects of edge and matrix habitats. *Ecological Applications* **7**:1170-1180.

This study draws together empirical tests with the effective area model or EAM. This model synthesizes information on the edge response of each species and a landscape map. It outputs

a prediction on species abundances in a habitat fragment. Using these tools, the authors attempt to address how the matrix influences bird distribution and how consistent the population-level responses of birds are at different edges of similar types. They found that matrix does have an effect on bird assemblages and that these matrix effects may commonly be expressed as edge effects. Though difficult to read, this paper does take the next step, incorporating a model in an attempt to understand the idiosyncrasies of edge effects.

Watson, J. E. M., R. J. Whittaker, and T. P. Dawson. 2004. Habitat structure and proximity to forest edge affect the abundance and distribution of forest-dependent birds in tropical coastal forests of southeastern Madagascar. *Biological Conservation* **120**:311-327.

We reviewed this paper in class and decided that it was probably written by an enthusiastic, young student trying to collect data for a master's thesis. Going against him was a paucity of time and expertise in experimental design. Among some of the problems were questionable observer training (only a few weeks), mistakes in the appendix, and issues of varying detectability of birds in different habitats. The authors also confounded matrix effects with edge effects. It does give some good baseline data perhaps, on the habitat preferences of various bird species in Madagascar's littoral forests.

Whelan, C. J., and G. G. Maina. 2005. Effects of season, understorey vegetation density, habitat edge and tree diameter on patch-use by bark-foraging birds. *Functional Ecology* **19**:529-536.

These authors approached edge effects from a behavioral ecology slant, which is fairly unique in the literature. They investigated four species of bark-foraging bird species (woodpeckers and nuthatches) and their responses to habitat edge and fragmentation. Whelan and Maina contend that patch use by these birds is a "represents the forager's optimal balance between food acquisition and predatory risk." To estimate this point, they used the giving up density or GUD measure – estimated by how much food is left in the experimental foraging patches after 2 days. They found that there is seasonal climactic variation; and birds in this guild had used the forest interior significantly more than the edge. It's a thorough experiment, but the use of a single site (no replication) and the clumping of 4 species into the analysis may be problematic. The latter especially questionable as predators may preferentially select a couple of the species within the guild, or conversely, guild members have more or less risky foraging techniques.

Nest Predation

Fraser, F. J., and P. J. Whitehead. 2005. Predation of artificial ground nests in Australian tropical savannas: inverse edge effects. *Wildlife Research* **32**:313-319.

While reading this, try to figure out the difference between predation and depredation. This is a simple experiment that involved placement of artificial nests near roads at two sites. The authors found that more predation occurred on artificial nests further away from roads – an inverse edge effect. They were relatively unsuccessful at identifying the predators from teeth marks on the clay eggs and concluded that since 42% of the identified predators were likely too small to depredate real eggs their findings should be extrapolated to reality with caution. It's a quick read and a good reference to review if one is to use artificial nests.

Gates, J. E., and L. W. Gysel. 1978. Avian nest dispersion and fledging success in field-forest ecotones. *Ecology* **59**:871-883.

This is the classic paper that spawned a whole sub-literature on the effects of edge on avian nesting behavior. It's a must read if you're to delve into the topic. Gates and Gysel studied 21 species of songbirds in Michigan. They found that birds seemingly preferred areas within 15 meters of the habitat discontinuity (aka "edge"). Unfortunately for the breeding birds, the concentration of nests in the aforementioned area was correlated with an increase in predation and cowbird parasitism, hence, coinage of the term "ecological trap."

Lahti, D. C. 2001. The "edge effect on nest predation" hypothesis after twenty years. *Biological Conservation* **99**:365-374.

Another meta-analysis: this one summarizes 55 published papers written between 1978 and 1998. Lahti considers three hypotheses: 1) nest predation rates increase near habitat edges; 2) edge varies by habitat type; 3) edge varies by habitat fragmentation. The results were varied, of course. The author did conclude that though the ecological trap hypothesis has been documented to occur, it did not happen in the majority of the studies reviewed. There is no evidence to support the latter hypotheses, but there is a trend towards a positive correlation between of edge effect and degree of landscape fragmentation. This is a good review of the literature, and definitely worthy for the references cited.

Paton, P. W. C. 1994. The effect of edge on avian nest success: how strong is the evidence? *Conservation Biology* **8**:17-26.

If you can't get enough of meta-analyses... Lahti's review renders this one irrelevant but Paton does include all of 5 parasitism studies, which Lahti omits. Paton's main conclusion is that since the abiotic effects of edge only penetrate within a relatively restricted region (within 50m), empirical studies should primarily concentrate on this region or just beyond it.