Do old-growth birds go to secondary forest? A multi-species hierarchical model of site occupancy by Amazon forest birds

G. Ferraz [a], S. M. Freitas [b], and U. M. Camargo [c]

[a] Departamento de Ecologia
Universidade Federal do Rio Grande do Sul
Porto Alegre, Brazil
goncalo.ferraz@ufrgs.br

[b] Geomatics and Landscape Ecology Laboratory
Carleton University
Ottawa, Canada
sandra.martinsdefreitas@glel.carleton.ca

[c] Metapopulation Research Group
University of Helsinki
Helsinki, Finland
ulisses.camargo@helsinki.fi

Abstract: Avoidance of an anticipated mass extinction of tropical forest species relies on whether old-growth species can survive in secondary forests. It has been established that old growth and secondary forest faunas become increasingly similar with time and do so faster at shorter distances between forest types; a tentative time window of 20-40 years has been proposed for full recovery of bird species richness. Here, we document the slow recovery of bird species richness in 25-year-old central Amazonian secondary growth and test predictions about which species are most likely to colonize disturbed forest habitats. Combining autonomous recording of bird vocalizations and multi-species hierarchical models developed in a Bayesian framework, we estimate site-occupancy parameters for 140 species in 151 secondary forest and old growth sites distributed over 350 square kilometers. Species richness, estimated with a zero-augmentation approach (Kéry and Royle 2009), was surprisingly similar between the two types of habitat: 15% higher in old growth than in secondary forest. Nonetheless, our species-specific *a priori* predictions of forest-type preference misrepresented a large number of species, partly due to detection failure. A majority of species occupies both forest types indifferently, but when they don't they are more likely to avoid than to favor secondary growth. Most of the species that were predicted to favor secondary forest are easier to detect there, but occupy both types of forest without distinction. Our results document a slow secondary-forest recovery through re-colonization from old growth, reflecting the irreplaceability of undisturbed forests but also stressing the potential value of secondary forest habitats for tropical forest species. This work illustrates the potential of combining a technological innovation in field sampling with multi-species hierarchical models to answer pressing applied questions at a very broad spatial and taxonomic scope.

References

Kéry, M. and Royle, J. A. (2009) Inference about species richness and community structure using species-specific occupancy models in the national Swiss Breeding bird survey MHB. Pages 639-656 *in* D. L. Thomson, E. G. Cooch, and M. J. Conroy (eds) Modeling

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