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Review: A Biologist's Guide to Fragmenting the Amazon (Including Why That's a Bad Idea)
Reviewed Work(s): Lessons from Amazonia: The Ecology and Conservation of a Fragmented Forest by R. O. Bierregaard, T. E. Lovejoy, C. Gascon and R. Mesquita

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Source: *Conservation Biology*, Vol. 16, No. 5 (Oct., 2002), pp. 1446-1448

Published by: Wiley for Society for Conservation Biology

Stable URL: <https://www.jstor.org/stable/3095346>

Accessed: 29-11-2021 17:20 UTC

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tractive groups in the past, current advocacy groups for off-road recreation or environmental protection, among others, can pressure, delay, and interfere with ecosystem-management decisions. Hirt's chapter about the Mount Graham red squirrel and the conflict between the U.S. Forest Service and politicians pulls together a condensed but uncomfortable story. This chapter reveals the realities of the difficulties of conservation when any group with political muscle—in this case the University of Arizona, a supposed enlightened institution, acts in its own best interest to get what it wants regardless of who loses.

The final chapter by Hal K. Rothman is an overview. Although a little too short, it does provide an effective framework from which to view the history provided and discusses directions for the future. The role of the Southwest forests as experimental areas (and ironically as leaders in management policies and “dead-end” places for “career-ending positions”) gives the history a special perspective. While lumber and other extractive companies have receded in importance, off-road vehicle use, expansion of ski resorts, and other recreational uses represent the current cultural exploitation of our national forests.

The individual chapters will vary in their appeal depending on the reader's own background and interests. But overall this book provides a better stimulus than many others I have read for a reassessment of national policies governing management of natural resources. Too often calls for reassessment come from groups with narrow self-interests and are thus easily overlooked. This collection of historical case studies is convincing because of the multiple perspectives and the general balance provided. The transformation of our forests during the last century is clear. The policies governing those transformations were well meaning at the time. Together, this collection advocates a more comprehensive ecosystem-management ap-

proach. We can only hope that results match intention in this round.

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A Biologist's Guide to Fragmenting the Amazon (Including Why That's a Bad Idea)

Lessons from Amazonia: the Ecology and Conservation of a Fragmented Forest. Bierregaard, R. O., T. E. Lovejoy, C. Gascon, and R. Mesquita, editors. 2002. Yale University Press, New Haven, Connecticut. 544 pp. \$65.00 (hardcover). ISBN 0-300-08483-8.

Unraveling the effects of habitat fragmentation has become one of the primary subdisciplines in conservation biology, and several excellent books on the topic have been published in recent years (Laurance & Bierregaard 1997; Young & Clark 2000). Have we come so far conceptually that a new one is needed? Probably not. *Lessons from Amazonia* is an important work, however, because it does what no other book has done to date: synthesized over 20 years of research on the effects of forest fragmentation in the Amazon, all of which was conducted at Brazil's Biological Dynamics of Forest Fragments Project (BDFFP). The BDFFP remains the world's largest-scale and longest-running experiment on the effects of fragmentation. As such, *Lessons from Amazonia* is both a biography of the BDFFP and a comprehensive catalog of the consequences of fragmentation.

Putting this catalog together was clearly no easy task. The book is divided into five major sections, and its 29 chapters are written by authors from nine different countries. To these authors the editors gave the daunting assignment of writing with two very different target audiences

in mind. The first is “field biologists,” whose research programs it was hoped the authors would inspire with their results. The second audience is “wildlife managers and conservation planners,” at whom the distilled “Conservation Lessons” at the end of each chapter are specifically aimed. This attempt to directly link the results of each study with the management of tropical forests is an important part of what sets this book apart from others on the subject.

Lessons from Amazonia begins with the section “Theory and Overview,” which chronicles the BDFFP's evolution from a team of five (a field director, cook, and three trail cutters) to its present status as a partnership between Brazil's National Institute for Amazonian Research and the Smithsonian Tropical Research Institute. It includes a cogent introduction to deforestation patterns in the Brazilian Amazon (Gascon et al.) and a review of the BDFFP's experimental design, which also details the isolation history of each fragment and the major faunal and botanical inventories carried out before and after isolation (Gascon & Bierregaard). This chapter also describes—in gory detail—the process by which thousands of hectares of tropical forest were leveled to create the BDFFP reserves.

The second section, “Forest Ecology and Genetics,” begins with a review of the central Amazon's surprisingly diverse and unique tree flora (Laurance). It will come as no surprise that the conservation of the more than 1300 tree species in the BDFFP reserves may require protected areas that are tens of thousands of hectares in size either to maintain viable populations of all species in a given family (Mori et al.) or because most species are locally rare and may have limited local genetic diversity (Lepsch-Cunha et al.). A further complicating factor, particularly in light of the short-term nature of most studies of forest ecology, is that trees in the tropics may be considerably older than previously imag-

ined. In one of the more simple yet thought-provoking chapters in the book, Chambers et al. used Carbon-14 dating to estimate the ages of trees from 15 commercially valuable timber species. They found that the average tree ≥ 10 cm diameter at breast height was at least 150 years old, and the oldest tree in their study was an astounding 1400 years old. Despite a sample size of only 44 individuals, Chambers et al. managed to more than double previous estimates of the maximum age of tropical trees.

Although the editors have organized the 14 chapters in the "Fragmentation Effects" section by taxonomic group—plant, invertebrate, and vertebrate communities—most of the chapters in this section actually focus on one of two issues that transcend taxonomic boundaries. The first issue is the influence of fragment size on species diversity and abundance. This focus clearly reflects the BDFFP's initial mission to determine the minimum size of reserves needed to protect tropical biotas. The second topic is the impact of proximity to forest edges, including how the type of matrix habitat in which fragments are embedded modulates edge effects.

Irrespective of whether one is interested in palms (Scariot), bees (de Oliveira), beetles (Didham), or primates (Gilbert & Setz), the message is frequently the same: protecting species diversity will ultimately require large tracts of undisturbed forest because most species are rare and patchily distributed. However, for a broad cross section of taxa ranging from ants (Vasconcelos et al.) to amphibians (Tocher et al.), the diversity found in fragments may depend in large part on the habitat that surrounds them. Even in the advanced stages of forest regeneration, some types of matrix appear to be a major barrier to individual dispersal, including for some presumably more mobile taxa such as understory birds (Stouffer & Borges).

My only regret is that this section did not include more chapters that moved beyond describing patterns of

abundance in fragments to actually testing the mechanisms responsible for these patterns. An excellent example of this limited subset of chapters is the one by Venticinqui and Fowler, which I consider one of book's highlights. They used survey data to parameterize metapopulation models for the spider *Anelosimus eximius*, a fascinating social species that builds communal webs containing up to 10,000 individuals. Whereas the abundance of colonies was higher in fragments than in continuous forest, the life expectancy of colonies in fragments was considerably lower than in unbroken habitat. Despite this increased mortality, the probability of simultaneous extinction from all fragments was actually minimal, because the dynamics of webs in the different fragments fluctuate asynchronously. This chapter, along with those on seedling recruitment (Benitez-Malvido) and pollination (Dick), is a good example of the mechanistic studies for which the BDFFP historically has been underutilized.

The fourth section, "Management Guidelines," includes chapters on topics broadly relating to the restoration, conservation, and politics of Amazonian forests. Two of them summarize empirical studies of regeneration in pastures, with one focusing on seedling establishment (Ganade) and the other on fire (Williamson & Mesquita). There are also chapters on selective logging (Higuchi), the use of remote sensing to describe changes in fragment quality (Logsdon et al.), and the application of heat-conductance models to predicting large-scale edge effects (Malcolm). Finally, there is an outstanding primer on the region's soils (Fearnside & Leal-Filho), one of the book's most informative and well-written chapters. Many will be surprised to learn that, despite being one of the most luxuriant ecosystems on the planet, much of the Amazon is built on soils that are highly acidic, toxic in levels of aluminum, and extremely poor in nutrients. Fearnside and Leal-Filho do an excellent job of walking the nonspecialist through

classification of soils, the influence of soil texture on properties such as water-retention capacity, and how different chemical elements interact with these properties to influence soil nutrient levels. It is unfortunate this chapter wasn't placed earlier in the book, because it would have been useful for interpreting patterns described by other authors such as low tree fertility (Laurance) and primate home ranges up to 10 times larger than those in other Neotropical sites (Spironello). The chapter by Fearnside and Leal-Filho should be required reading in all courses in tropical ecology.

The book ends with a one-chapter section listing 13 "principles of forest fragmentation and conservation in the Amazon," as well as publications and theses resulting from BDFFP research (the list is continuously updated and can be found at www.inpa.gov.br/pdbff). Summarizing two decades of complex, frequently contradictory results is far from easy, and I found this chapter to be a surprisingly comprehensive and lucid distillation. Its only weakness was the occasional platitudes, such as "roads are an enemy" and "conservation is best achieved through people," which I think oversimplify the social and economic complexities of conservation and development in tropical countries.

Lessons from Amazonia is not without its shortcomings: a few of the authors have simply summarized their previously published papers, and judicious editing would have eliminated the redundant descriptions of study sites presented in multiple chapters. Also, the two-audience approach, although laudable, is not entirely successful. I was occasionally frustrated by lack of details on experimental design or statistical analysis, and some of the management guidelines presented by authors are either already well known to conservation professionals (e.g., "minimize edge") or not overly useful (e.g., "reserves should be large"). Despite these criticisms, however, *Lessons from Amazonia* is a solid and wel-

come addition to the fragmentation literature. It is comprehensive and rich in data and provides a good introduction to the ecology of the central Amazon. The clarity of the writing and synthetic nature of most chapters makes it an excellent source of readings for both undergraduate and graduate courses, and students will find it a good place to mine for

thesis topics. This book leaves no doubt as to why in 23 short years the BDFFP has matured into one of the premier sites in Latin America for conservation research and training.

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Erratum

In the April 2002 issue (Volume 16) of *Conservation Biology*, there are several errors in the table on page 299. N. Sloan's page-proof corrections to the table were not incorporated by the publisher. A revised version follows.