HABITAT FRAGMENTATION, EDGE EFFECTS AND BIOLOGICAL CORRIDORS IN TROPICAL ECOSYSTEMS

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Keywords: Biodiversity loss, connectivity, extinction, fragment size, habitat loss, isolation, tropical rain forest.

Contents

1. Introduction
2. Habitat fragmentation
   2.1. Impact of Habitat Fragmentation on Populations
   2.2. Fragmentation Effects on Communities
   2.3. Fragmentation Effects on Ecosystems
3. Edge effects
4. Influence of fragment spatial attributes
   4.1. Fragment Size
   4.2. Fragment Shape
   4.3. Fragment Isolation
   4.4. Matrix Type
5. Biological corridors
6. Conclusions
Acknowledgements
Glossary
Bibliography
Biographical Sketches

Summary

Tropical rain forest fragmentation is one of the most pervasive threats to the conservation of biological diversity, affecting different levels of biological organization including populations, communities and ecosystems. Forest fragmentation involves the creation of “habitat edges” and consequently the so called “edge effects” that generally have a negative impact on the biotic and physical environment. The spatial attributes of fragments in the landscape include fragment size, shape, isolation and the matrix type surrounding the fragments. Although these spatial attributes influence the prevalence and magnitude of the edge effects, they can constitute important threats to biodiversity by themselves. The increment of fragment isolation in highly fragmented landscapes can negatively affect inter-fragment dispersal movements of both plant and animal species, modifying important ecological processes such as pollination and seed dispersal. In this sense, actions to increase the population size and the persistence of several plant and animal species include the establishment of biological corridors. Biological corridors increase landscape connectivity, and may reduce extinction rates by increasing inter-fragment movements and favoring the access to resources available in

more than one forest fragment.

1. Introduction

Deforestation and forest fragmentation have become the most important threats for the maintenance of biodiversity. Tropical rain forests are one of the most affected ecosystems with annual rates of deforestation between 100 000 and 150 000 km^2. Tropical forests are also one of the most biodiverse ecosystems of the planet as they contain between 50% and 80% of all the terrestrial species, and they have a critical role on the maintenance of the planet homeostasis. Therefore, their destruction may not only threaten the maintenance of biodiversity, but could also affect climatic and hydrological cycles at local, regional and global scales. In addition to the loss of forest cover, the process of fragmentation results in a change on the spatial pattern of the remaining forest (e.g., increase in number of forest fragments, decrease in fragment size, and increase in fragment isolation), leading to the loss of ecosystem continuity. These spatial changes produce a wide range of effects across several levels of biological organization, affecting biological populations and communities, as well as ecological processes that may modify the overall functioning of the ecosystem.

The magnitude of the effects that tropical rain forest fragmentation has on the biota and physical environment depend on different elements or aspects that characterize the fragmented landscapes including: total amount of forest cover, number of forest fragments, fragment size, shape and isolation, and the characteristics of the matrix (i.e., modified native vegetation such as deforested areas, cattle pasture, agricultural crops, urban areas, etc.) that surrounds the fragments. These same elements would also determine the magnitude of the so called “edge effects”, which are an inevitable consequence of forest fragmentation and imply the influence of processes originated in the matrix that surrounds the fragments. In this chapter we describe the consequences that tropical rain forest fragmentation has across different levels of biological organization including populations, communities and ecosystems, as well as on the physical environment of the remaining forest. Thereafter, we describe the influence of edge effects and fragment attributes (i.e., size, shape, isolation and surrounding matrix) on the biota and physical environment. Finally, we pointed out the importance and inconveniences of the so called biological corridors, present in some fragmented landscapes and relevant for the maintenance of the remaining plant and animal populations within the fragments. For each section, the examples given on fragmentation effects come from studies conducted in different tropical forests around the world.

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Biographical Sketches

Julieta Benítez-Malvido received the Bachelors degree in Biology (*cum laude*) from Universidad Autónoma Metropolitana-Iztapalapa, in Mexico City in 1988; the Master in Science degree in Ecology from Durham University, at the United Kingdom; and the PhD. from Cambridge University, United Kingdom in 1994. She is a principal researcher in the Center for Ecosystem Research, National Autonomous University of Mexico (UNAM, 1996-present); assistant professor in Population Ecology and Conservation; and Research Associate, to the Biological Dynamics of Forest Fragments Project, National Institute for Research in the Amazon (INPA)-Smithsonian Institution (1991-present) and at the Long Term Ecosystem Research (LTER), international program at the Chamela site (Mexico). Current research sites include the Brazilian Amazon and several locations at tropical Mexico (Los Tuxtlas, Chajul, Cozumel and Chamela). Research interests: tropical ecology; tropical forest recovery after human disturbances (e.g., fragmentation, deforestation and impact of roads); biotic interactions of plants with herbivores and pathogens in disturbed tropical habitats, and tropical forest restoration.

Víctor Arroyo-Rodríguez received the B.Sc. (biology) degree from Universidad Autónoma de Madrid, Spain, in 2002, and both the M.Sc. and Ph.D. degrees from Instituto de Ecología A.C., Mexico, in 2005 and 2007, respectively. Nowadays he is a postdoctoral fellow at the Centro de Investigaciones en Ecosistemas (Universidad Nacional Autónoma de México). His main research interest is conservation biology in human-modified tropical rain forests. He has published ca. 20 papers in wildlife ecology, forest

ecology and biodiversity conservation in fragmented landscapes, and has scientific presentations in numerous national and international congresses and symposia.