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Tropical Forest Responses to Large-Scale Experiments

Although artificial by nature, experiments are a necessary part of ecology if we are to understand key mechanisms driving ecosystem structure and function. Experiments range in scale from microscopic to landscape; large-scale experiments are typically more logistically challenging than are small-scale experiments or observational studies. Recently, researchers have been interested in utilizing large-scale experiments to determine how forests respond to environmental change. Large-scale experiments have been more common in temperate than in tropical forests, yet tropical forests contain over half of the world's species in just 7 percent of the world's land area. Key threats to tropical biodiversity, such as habitat loss, overharvest, and climate change, are topics included in the Special Section in this issue, entitled *Tropical Forest Responses to Large-Scale Experiments*.

Here is a collation of six synthesis articles covering recent large-scale field experiments that have been highly influential in tropical ecology and that further our understanding of how these forests will respond to global environmental change. The first two articles focus on how human-induced habitat loss or hunting has altered tropical forests. Mesquita and colleagues synthesize results on 25 years of vegetation responses to logging and subsequent burning. They found that Amazon rainforests can regenerate following logging, yet that if the logged forest is converted to pasture by burning and then abandoned, it will at best recover to forest dominated by a single species. Kurten and Carson discuss plant responses to 10 years of exclusion of ground-dwelling vertebrates. They found that excluding vertebrate herbivores and seed predators increased tree stem density and increased plant species richness; they further explain how the elimination of key vertebrates may account for forest structural changes.

The following four articles address global climate change effects on tropical forests—specifically, hurricanes, drought, fire, and temperature changes. By recreating the dominant effects of a hurricane in a tropical forest in Puerto Rico, Shiels and colleagues demonstrate the complex series of events following canopy opening and detritus deposition to the forest floor that cascade through the forest ecosystem and food web, thereby altering forest structure and function. Meir and colleagues synthesize conclusions about the effects of drought, after reviewing findings from all eight rainfall-reduction field experiments reported from tropical forests. Balch and colleagues show that Amazon forests can withstand single, low-intensity fires, yet that repeated fires during drought kill most existing trees and facilitate an invasive grass–fire cycle, especially at forest edges. Nottingham and colleagues show the sensitivity of soil organic matter cycling to temperature change by experimentally moving soil cores along an elevation gradient in the Peruvian Andes.

We hope that this special section of hot-topic synthesis articles will provide a long-lasting source of understanding of tropical forests, as well as provide motivation and direction for establishing future research needs in these threatened ecosystems.

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