SEASONALLY DRY TROPICAL FORESTS

Seasonally Dry Tropical Forests

ECOLOGY AND CONSERVATION

EDITED BY

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INTRODUCTION

RODOLFO DIRZO, HILLARY S. YOUNG, HAROLD A. MOONEY,
AND GERARDO CEBALLOS

The usual perception that the term *tropical forests* refers to evergreen tropical rain or moist forests is inaccurate. The tropical forest biome is, in reality, a mosaic of different vegetation entities including, at mid elevations of the tropics, the patchy and biogeographically restricted tropical cloud forests and, in the lowlands, the rain forest per se and the seasonally dry tropical forests (SDTFs). At least part of the biased perception of the term *tropical forest* stems from the fact that, by far, tropical rain forests are the most studied and, indeed, most popularized among the general public. SDTFs, in contrast, have been seriously neglected. For example, only 14 percent of articles published on tropical environments between 1950 and 2005 focus on dry forests (Sánchez-Azofeifa et al. 2005). Such scientific bias, however, determines that our understanding of the planet's biodiversity, the ecosystem services it provides, and the anthropogenic threats to it in general, and to the tropical forest biome in particular, is in turn biased and will remain grossly incomplete if we do not pay attention to the SDTFs still present in the different parts of the world. The present volume is an attempt to fill part of this lacuna in our knowledge on tropical ecology by analyzing the ecology and conservation of SDTFs in Latin America. This volume represents, also, a sequel to the first and only other global synthesis, (Bullock et al. 1995) and provides a complement to some recent efforts conducted at a more local level (e.g., Ceballos et al. 2010).

SDTFs are forests with a mean annual temperature typically greater than 17 degrees Celsius, rainfall ranging from 250 to 2000 millimeters annually, and an annual ratio of potential evapotranspiration to precipitation of less than 1.0. However, by far the most distinctive character of this forest type is its seasonality, with 4 to 6 dry months (rainfall less than 100 millimeters), which in turn determines the distinctive phenology of the plants and the forest as a whole: an alternating deciduousness during the dry season, followed by an evergreen physiognomy during the rainy season. Such environmental seasonality represents a unique combination of challenges for the living biota contained within SDTFs and, accordingly, results in a series of special morphological, physiological, and behavioral

adaptations of plants (chap. 8), animals (chap. 5, 6), fungi and soil organisms (chap. 4), and probably microorganisms. The climatic seasonality and the coupled seasonality of organisms and their ecological roles determine in turn the ecosystem processes (productivity, water and nutrient cycling, etc.) that characterize SDTFs (chap. 7–10).

Beyond their phenology and seasonality, three “macroscopic” features define the importance of SDTFs. The first is their wide coverage, encompassing 42 percent of tropical ecosystems worldwide, globally representing the second largest type of tropical forest (Miles et al. 2006; chap. 3). Second is their high biological diversity, which, although not comparable with the species richness of tropical rain forests, is nevertheless considerable (chap. 1, 4, 5, 6, 12). SDTF biodiversity includes other facets of great significance, in particular SDTFs’ remarkable concentration of endemic species, their diversity of life-forms and functional groups of plants and animals (Dirzo and Raven 2003), and their incomparable beta diversity, or spatial species turnover (chap. 1). SDTF beta diversity is underscored by the high plant species dissimilarity (or floristic distance values) among sites, both within a relatively restricted region (e.g., Mexico, with a mean dissimilarity of 91 percent among all possible pair-wise comparisons of 20 study sites; Trejo and Dirzo 2002) and among the 21 major geographic nuclei that encompass the SDTF in the Latin American region (with 203 out of 253 possible pairs having dissimilarity values of more than 70 percent; chap. 1). The unusual SDTF beta diversity, combined with the impressive concentration of endemic taxa (e.g., 60 percent of plant species in Mexican SDTF), is an aspect that has important biogeographic (chap. 2) and conservation (e.g., chap. 12–16) implications. Finally, a third distinctive feature of SDTFs is their uneven distribution across the tropical regions of the world. Such forests have a greater distribution in the Neotropical and Caribbean region, encompassing approximately 700,000 square kilometers of land covered by SDTFs, representing 67 percent of the global coverage of this ecosystem.

On the other hand, among the region’s tropical forests, SDTFs are regarded as the most threatened, with an estimated conversion of at least 48 percent of its extent into other land uses (Miles et al. 2006), an estimate similar to that of chapter 3, suggesting that only 44 percent of SDTF remains in the region (see also chap. 12, which cites an estimate of only 30 percent). Furthermore, a significant proportion of the remaining area of SDTF is fragmented to a varying degree, with important negative consequences on species and genetic diversity (chap. 11), as well as on several ecological processes, including species interactions crucial to plant repro-

duction, plant recruitment, and forest regeneration (chap. 11). In addition to land use change, other global environmental changes, in particular climatic change (chap. 16), have the potential to affect the structure, diversity, and functioning of SDTFs as well as the delivery of crucial ecosystem services they provide to human societies (chap. 15).

Given the dramatic magnitude of forest conversion and the persisting high rate of SDTF deforestation, coupled with the fact that protected areas including SDTF are extremely limited (e.g., only about 6 percent of SDTF in Central America has protected-area status; Miles et al. 2006), conservation of such vegetation and its biodiversity, ecosystem processes, and services will depend on how much SDTF biodiversity can be preserved in the mosaic of forest remnants and human-occupied areas—the agroscape (chap. 12). Conservation of SDTFs into the future will depend also on the extent to which such landscape mosaics can be used as biotic sources for restoration of degraded areas (chap. 12, 13) and the extent to which such agroscape can be valued for its biodiversity and maintenance of ecosystem services (chap. 15). Recent research suggests that SDTF biodiversity conservation in the agroscape, although quite challenging, holds high promise (chap. 12). Such hope is enhanced by isolated examples that show that the useful flora of seasonally dry Neotropical forests is of considerable cultural and economic importance (chap. 14). This combination of facts coupled with an appreciation of the traditional knowledge of the rural inhabitants of SDTF areas suggest that forest management, involving local communities, has potential to become sustainable (chap. 14).

The exuberant biodiversity of SDTFs and the ecosystem processes that characterize them represent an ecological resource we are just beginning to learn how to interpret. This is a task we urgently need to confront. We hope this volume will contribute to such an endeavor.

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