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Editorial: Seasonally dry tropical forests: new insights for their knowledge and conservation

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Editorial on the Research Topic
Seasonally dry tropical forests: new insights for their knowledge and conservation

Typically, seasonally dry tropical forests (SDTF) feature a dense canopy, predominantly deciduous during the extended dry season lasting 4–8 months. This canopy provides shade, and in contrast to savannas, STDFs lack an abundant grass layer and they seldom burn in the absence of human-induced fires, as evidenced by the lack of fire adaptations in their flora (Pennington et al., 2000). Under this definition, SDTF are concentrated in the Americas, where they are found from northern Mexico to the north of Argentina and some in areas of the Caribbean. Elsewhere, STDF are also found in some parts of Africa, Madagascar, and in some small areas of Southeast Asia (Pennington et al., 2018). These forests have an extraordinarily diverse flora and fauna of in taxonomic, phylogenetic, and functional dimensions, and at continental scale they may be almost as species rich as rain forests (Dryflor et al., 2016; Prieto-Torres et al., 2019, 2021b; Arango et al., 2021). In addition, SDTF also provide multiple ecosystem services for human communities living in and around them. Despite their extensive distribution and rich biodiversity, these forests have garnered limited focus from ecologists and conservationists. In fact, nearly 65% of their original vegetation in Latin America has been lost (Portillo-Quintero and Sánchez-Azofeifa, 2010), and their representation under some kind of protected area is <10% of their current extent, which is significantly less than the Aichi target (Convention on Biological Diversity, 2016; Prieto-Torres et al., 2018). Moreover, new evidence indicates that their representativeness of inhabiting species (both threatened and non-threatened) within protected areas is woefully inadequate and will be strongly affected by future global changes (Prieto-Torres et al., 2021a).

Given this dire scenario, urgent studies on SDTF biodiversity are imperative. In SDTF, seasonality represents the main driver for many biological and ecosystem processes. Thus, water availability, largely mediated by temperature, precipitation, topography, and soil characteristics, is considered one of the main factors influencing niche partitioning and spatial organization of plant SDTF communities (Pennington et al., 2000; González-M et al., 2021; Prieto-Torres et al., 2021b; Quisehuatl-Medina et al., 2023). Understanding how species diversity varies through different micro- and macroenvironmental conditions and how species respond in functional and phylogenetical terms is currently a growing topic (Méndez-Toribio et al., 2017). For instance, variations in climatic conditions occurring at landscape scales can define the presence or absence of some species depending on their eco-physiological strategy to avoid or tolerate drought (González-M et al., 2021; Quisehuatl-Medina et al., 2023). Thus, considering that under climate change scenarios the marked dry season of the SDTF may become stronger or more widespread in the near future, SDTF may be facing changes in their vegetation structure and in their biodiversity in general (Souza e Silva et al., 2019).

These probable shifts in biodiversity underscore the challenges and threats facing the long-term protection of SDTF. Therefore, it is extremely important to consider the potential effects of both land-use and climate change to support policy makers at both national and global scales. Nevertheless, these issues remain poorly studied and more research is needed.

New insights

This collection assembles seven articles dedicated to ecological research in various regions of the Americas' seasonally dry tropical forests. Although most of the studies focus on plants (six) and one in animals (bats), this Research Topic assembles studies from a wide range of disciplines covering links mainly between functional ecology and community ecology and how these findings can be applied to restoration issues. The first article by Vergara Fagundes et al. revealed five coordinated trade-offs in tree' groups across the spatial heterogeneity of aridity into SDTF distribution, which sheds new light on the functional complexity (including the relationship of below- and above-ground traits) of species to occupy more arid regions. This insight challenges traditional assumptions and highlights the functional complexity of species in SDTF.

Caleño-Ruiz et al. demonstrated the influence of environmental conditions and plant characteristics on biomass stocks and productivity in Colombian SDTF. They concluded that strong coordinated effects of soil resources and functional traits determine local biomass processes of SDTF with a role of conservative trait species types, whereby these species promote community assembly and functioning but are also vulnerable to potential changes in water availability. On the other hand, Salazar Villegas et al. found that tree community assembly and spatial patterns formation are regulated by environmental heterogeneity, and both facilitative and competitive processes act simultaneously, but at different spatial scales and involving different species. In this study, they highlight the importance of the association patterns, not only for our understanding of community assembly, but also to provide restoration directions. These findings are closely related to the study performed by Ávila-Lovera et al. who analyzed the changes of ecophysiological traits along a successional gradient in a Venezuelan STDF and concluded that some native species from the SDTF have good physiological performance in successional sites and, therefore, could be used to restore degraded areas.

Another very interesting article by Muñoz et al. is a long-term study about the SDTF from Oaxaca, Mexico. They discussed about the importance of lithological substrates in vegetation structure and species composition through time, as well as the need to examine the role of functional attributes on old-growth forests dynamics in order to provide a better understanding of the impacts of extreme climatic events on forest attributes, ecosystem state shift and tipping points. Moreover, Morffi-Mestre et al. compared the leaf litter decomposition rates of dominant tree species from the Yucatan Peninsula (Mexico) along a successional chronosequences from different microenvironmental conditions. Results of this study highlight the importance of analyzing species-specific responses, especially for dominant species that contribute most to leaf litter decomposition, because changes on soil organic carbon and pH suggesting susceptibility to climate change and soil erosion, particularly in sloping areas.

The final article in this Research Topic is by Díaz-B et al. who found association between bat functional traits with landscape, climatic, and land-use intensity variables. Their findings provide insights into how bat functional traits also vary in their relationships with environmental conditions in harsh environments such as SDTF.

Concluding remarks

As a Research Topic, these articles have important implications for research, policy, conservation, and restoration. Findings herein provide valuable evidence that future studies/actions should pay special attention to functional trait to improve management practices in these threatened forests, especially those associated to the water stress tolerance by species and the community assembly (both animal and plants), but also considering the potential impacts of future climate and land-use changes (Santos et al., 2014; Allen et al., 2017). Significant knowledge gaps for these topics remain for the SDTF and their environmental heterogeneity (Pennington et al., 2018; Silveira et al., 2022). We hope that the volume contributes to scientific research for use by readers, scientists, conservationists, and decision-making managers of the world's seasonally dry tropical forest.

Author contributions

LL-T: Conceptualization, Supervision, Writing – original draft, Writing – review & editing. DP-T: Conceptualization, Supervision, Writing – original draft, Writing – review & editing. FB: Supervision, Writing – review & editing. NR: Supervision, Writing – review & editing. RP: Supervision, Writing – review & editing.

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Conflict of interest

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