Trends in Ecology & Evolution

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Letter

Neglect of the Tropics Is Widespread in Ecology and Evolution: A Comment on Clarke *et al.*

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One Sentence Summary

Neglect of the tropics is a widespread problem across ecology and evolution, and not specific to the field of biodiversity and ecosystem function.

In a recent paper, Clarke *et al.* [1] present evidence for a bias against the tropics in studies of biodiversity–ecosystem function (BEF). Unfortunately, BEF is not the only field in ecology and evolution that suffers from gross geographical sampling biases; rather, this is just one example of a more widespread lack of studies from the tropics that needs to be recognized and accounted for – especially in the face of growing conservation challenges.

What Is Tropical?

Surprisingly, a clear definition of what constitutes tropical versus non-tropical ecosystems does not exist. This may seem illogical to many ecologists and evolutionary biologists given the existence of strict latitudinal boundaries relating to direct solar exposure (e.g., between 23.4° North and South of the equator; the tropics of Cancer and Capricorn, respectively); however, this criterion is frequently ignored or altered based on local climate conditions. For example, even Clarke *et al.* [1] in their review categorize the tropics using the latitudinal limits of ±23.5°, a widely used yet slightly inaccurate measure (and one frequently inflated up to ±30°). Conversely, those regions falling within tropical latitudes but that do not adhere to classical stereotypes of tropical ecosystems (e.g., cold montane or dry desert ecosystems) are often considered 'non-tropical'. Although this may seem pedantic, until ecologists agree on what constitute tropical versus non-tropical regions and ecosystems, discussions of geographical biases in global research efforts remain somewhat stifled. Regardless of their definition, the tropics represent a significant portion of the Earth's land surface (e.g., approximately 36% between ±23.4°) and are home to the vast majority of species.

Tropical versus Non-Tropical Extinction Risk

It is widely hypothesized that tropical species and ecosystems will be at a greater overall risk from both short- and long-term global stressors than species in non-tropical (i.e., temperate) regions. Rates of habitat loss, alteration, and fragmentation are highest in the tropics relative to other areas, constituting the greatest immediate threat to tropical biodiversity and ecosystems. Similarly, those species under threat from poaching for medicine and the bushmeat trade are heavily skewed toward the tropics. Under long-term global stressors, such as climate change, tropical species are also considered under elevated risk relative to non-tropical species [2]. In response to contemporary climate change, many temperate species have been observed to shift distributional ranges to track preferred climatic conditions, an option not available to tropical species due to the absence of a latitudinal temperature gradient [3]. Even if able to migrate, many tropical species may still find themselves at a higher extinction risk compared with temperate species due to higher levels of ecological specialization [4].

Given the myriad evidence of the threats facing tropical species at both the short (e.g., habitat change and loss) and long (e.g., climate change) temporal scales, alongside the fact that the tropics support the greatest proportion of global biodiversity and the fact that they have been important in the development of many classic ecological and evolutionary theories, it would be logical to assume that research efforts in ecology and evolution are being directed toward the tropical realm. However, this is simply not true.

Major Geographic Biases in Ecology and Evolution: Neglect of the Tropics

As observed by Clarke *et al.* [1] in studies of BEF, the tropics are consistently and dramatically neglected in almost all fields of ecology and evolution. Global ecological data sets largely mirror each other in their sampling biases. Of the >700 million georeferenced occurrence records in the Global Biodiversity Information Facility (GBIF) approximately 30% are from the USA, with the majority (>80%) stemming from only 10 countries, of which only one is tropical [5]. Similarly, studies of core ecological and evolutionary topics such as biogeochemistry [6], taxonomy [7], interspecific competition [8], and paleoecology [9] all underrepresent the tropics, as well as those crisis-driven disciplines such as conservation and climate change biology [10]. Within the tropics, many of those habitats considered atypical are also subject to gross undersampling [11].

It should be noted that these geographic sampling biases do not reflect a lack of interest in the tropics or that tropical systems are somehow less 'important' than temperate systems. Indeed, many foundational ideas and theorems of ecology and evolutionary biology are derived from tropical ecosystems [12]. However, many researchers and research institutions are based in temperate regions, with relatively few dedicating the additional time and money needed to conduct tropical studies. One consequence of this is that the vast majority of tropical studies result from well-established research stations (e.g., Barro Colorado Island in Panama and La Selva Biological Station in Costa Rica), which allow researchers to bypass many of these local logistical hurdles.

Tropical Field Studies Are a Priority

At its most basic, increased research effort in the tropics is desperately needed. We understand, however, that the allocation of research effort is not dictated solely by the choices of researchers, but is intimately linked with logistical difficulties, as well as research policies and funding, international and domestic politics, and local sociocultural factors. In the absence of a dramatic increase in tropical field studies, what is needed, and what we believe can be readily achieved, is a more honest and open discussion of the scope of data sets and the areas that they are truly representing (and not representing) when used to understand and model global ecological and evolutionary phenomena.

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