

# Recreation Ecology in Brazil: a preliminary review.

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## Introduction

Visitation in Brazilian National Parks (NP) increased twofold in the last decade. Managers must take advantage of this as an opportunity for increasing environmental awareness and nature conservation support. On the other hand, NP together with other protected areas (PAs) and natural areas are not enough for the persistence of species and maintenance of environmental services. Biodiversity crisis is hampering unprecedented number of threatened species and collapsing ecosystems.

PA and particularly NP, in Brazil, are the most important tools for conservation strategies. Despite its potential, visitation in Brazilian PAs is still limited in terms of delivering direct benefits to nature conservation, to environmental awareness, and to local people. Resources to identify and monitor recreation impacts are still scarce in Brazil. PAs and PAs agencies have insufficient staff, time and resources, despite the increasing effort in capacity building for planning and managing visitation. In this context, agencies prioritize to establish new attractions, increase visitors flow, and provide basic services, mainly through public-private partnerships. Identifying and monitoring the impacts in a more systematic way is fundamental to track the sustainability of ecotourism and to support PA managers.

Research institutions, particularly universities, are better positioned to fill this gap by building transdisciplinary approaches. Research on nature tourism in Brazil, are more focused on social science using qualitative methods. Quantitative or mixed-methods to monitor tourism and recreation impacts are still in an initial stage and must be stimulated. In this study, we conduct a preliminary literature review on recreation ecology in Brazil.

## Methods

We analyzed the types and numbers of studies conducted in different biomes, ecoregions, habitats, ecosystems, and upon distinct taxonomic groups; the metrics used, as well as the types of recreation activities, impacts, and specific sites sampled. We searched for papers in *Web of Science* and *Google scholar* engines, using keywords: *Brazil; tourism; impact; environment*; and also changing *environment to nature* or to *biodiversity*, and adding *protected area*. In a preliminary effort, 600 papers were analyzed, from which we selected 20 studies designed to measure the impact of recreation activities on biodiversity.

## Preliminary results and next steps

Two thirds of the papers concentrated in the Marine-Coastal biome, mostly on coral reefs, but also on rocky shores, sand beaches and seagrass meadow ecosystems. Recreation activities considered on these sites were swimming, snorkeling, splashing, walking, and boat tours. Impacts evaluated were human presence (visitor occurrence and densities), trampling, and handling and removal of organisms.

Macrobenthic fauna and flora were the most frequent taxa studied in coral reefs; fishes, crustaceans, birds and dolphins were also studied in other marine ecosystems. In Brazilian tropical forests, mammals were studied in three different areas (north and southern Amazon, and in the Atlantic Forest), always comparing visited vs non-visited trails. Birds were studied in Pantanal, and fishes in streams in the Cerrado biome.

Based on these preliminary results, except for marine ecosystems we have a very limited knowledge about the actual impacts of recreation on terrestrial ecosystems in Brazil. We have a very limited idea of the recreation impacts on forest mammals, on fishes in the streams of Bonito, a famous world nature tourism destination, and birds in Pantanal. At a broader level, we have almost no idea about the recreation impacts in the whole biodiversity in Brazil, considering different species, ecosystems, habitats, and also dozens of activities under different levels of intensity. Impacts on plant species, vertebrate and invertebrates in the Cerrado, Caatinga, and other fragile biomes and ecosystems are unknown.

This ongoing study is being expanded to include additional sampling efforts, clarifying taxonomic and ecological gaps on what we don't know about the impacts of recreation in Brazil. Besides international journals, we will also include Brazilian journals and papers written in Brazilian language (Portuguese). Unpublished thesis and dissertations could also bring more studies into the ongoing literature review.

## Recommendations

On the one hand, researchers must concentrate efforts to understand recreation impacts on less studied ecosystems and organisms, and particularly those ones with extraordinary importance for the maintenance of biodiversity and ecosystem process, such as flagship, landscape or keystone species. On the other hand, PAs managers and agencies must incentivize research on these topics, promoting dialogue between managers and researchers, providing facilities, infrastructure and funds for recreation ecology studies.

At the same time, visitation must be managed carefully, due to the escalating increase in visitor flows in the Brazilian NPs, our most precious land for world's biodiversity protection. Based on precautionary principle, visitation in strictly protected areas must avoid the increase in trail density, and potential impacts on sensitive habitats and threatened species.

Simple protocols to monitor visitor's impact, as well as involving volunteers and citizen science approach seems to be promising to couple visitor management with nature conservation. Finally, considering both the high level of threatened species and ecosystems and the high environmental perception of Brazilian NP visitors, we must find ways to minimize negative impacts and optimize direct benefits to nature conservation.

## References

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