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Editorial: Global Patterns and Drivers of Forest Loss and Degradation Within Protected Areas

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Editorial on the Research Topic

Global Patterns and Drivers of Forest Loss and Degradation Within Protected Areas

Forests host most of the world's terrestrial biodiversity and are a major carbon sink (Brockerhoff et al., 2017; FAO and UNEP, 2020). Yet, forests across the globe continue to be degraded and lost (Curtis et al., 2018; FAO and UNEP, 2020) resulting in significant biodiversity declines and increases in human-induced carbon emissions (Houghton and Nassikas, 2018; Qin et al., 2021). Protected areas (PAs) represent one of our most important strategies for safeguarding forests and the ecosystem services they provide (Watson et al., 2014; Yang et al., 2019). Several studies, however, have shown that deforestation rates remain high even within many of the world's PAs (Wade et al., 2020; Wolf et al., 2021). Hence, understanding the patterns and drivers of forest loss and degradation within PAs remains a key research objective. This collection brings together a series of articles that shed light on essential aspects of those patterns and drivers.

Fritz et al. used a novel dataset developed through the visual interpretation of high-resolution satellite imagery by volunteers to quantify global patterns and drivers of forest loss within the world's tropical regions for the period 2008 to 2019. The authors showed that most deforestation has occurred in Latin America, followed by Asia and Africa. Forest loss within PAs in Latin America and Africa was lower than in unprotected areas, but the opposite was true in Asia. In fact, forest loss rates within PAs in Asia were more than double the corresponding rates in Latin America and Africa. The main drivers of deforestation within PAs were pastures and shifting cultivation in Latin America and shifting cultivation and other subsistence agriculture in Africa. In Asia, the main drivers were forest management (e.g., logging and timber plantations) and shifting cultivation, followed closely by commercial oil palm plantations. Deforestation rates within strict PAs (defined by the authors as those belonging to IUCN Categories I-IV) were not necessarily lower than in other PAs, a finding in line with other recent studies (Leberger et al., 2020; Elleason et al., 2021). Alejo et al. evaluated the effectiveness of community-managed PAs in Petén, Guatemala and Acre, Brazil, in terms of their capacity to preserve carbon stocks through avoided land-use carbon emissions. They found that community-managed PAs were as effective as strict PAs (i.e., areas in IUCN Categories I-IV) and even more effective than PAs where multiple sustainable human uses are permitted (IUCN Categories V-VI). Consequently, Alejo et al. concluded that the decentralized governance of PAs—in which social and ecological outcomes could potentially converge—can play an important role in mitigating climate change.

Imron et al. used a dataset capturing forest fires over a 15-year period to assess the conservation effectiveness of PAs, specifically of the Padang Sugihan Wildlife Reserve (PSWR) in Indonesia—a tropical peatland important for the conservation of the Sumatran elephant and other endangered species. The authors found that compared to the 10 km buffer surrounding the wildlife reserve, there were fewer fire occurrences within PSWR during the wet years. However, during the dry years, the fire incidents within PSWR were as frequent as in the surrounding buffer, especially in

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parts of the reserve with higher human access, such as near canals and roads. Lisboa et al. also examined the impact of roads within forested PAs, focusing this time on the plant communities in the Moribane Forest Reserve in Mozambique. They found that areas near roads tended to have higher plant species richness, which was albeit driven—at least partly—by the increased presence of alien plant species.

Massinga et al. explored the socioeconomic factors driving forest loss in two PAs in Mozambique, namely the Moribane Forest Reserve and Serra Chôa. The authors overlayed spatial data capturing the rates of tree cover loss within the PAs between the years 2000 to 2020 and socioeconomic data collected through social surveys. They found that higher deforestation rates tended to be associated with increased access to markets and better road infrastructure. These two factors alone made agriculture—and consequently forest clearing—an attractive source of income for the local communities, particularly in the absence of alternative income sources. On a larger scale, however, Dehmel et al. found that human development correlated negatively with tree cover loss in PAs in sub-Saharan Africa. The purpose of the analysis of Dehmel et al. was to explore a potential link between good governance and reduced deforestation rates within PAs. Governance is often cited as a major factor affecting the effectiveness of PAs worldwide; however, its exact influence remains challenging to assess on a large scale (Geldmann et al., 2019; Mammides, 2020). Dehmel et al. showed that governance—measured at the country level using the Ibrahim Index of African Governance (IIAG)—was only weakly correlated with tree cover loss within PAs (and only after environmental governance was included in the model). Lastly, Lawrence et al. showed that the climate effects of the carbon released from the aboveground forest biomass due to forest loss and degradation are determined also by shifts in biophysical processes (e.g., water and energy balances). This finding is important because it suggests that the role of forests for climate change mitigation and adaptation is even greater than previously thought due to the additional cooling effects that forests provide through these biophysical processes, particularly in the tropics.

Together, the articles in this collection highlight a wide range of important factors impacting forest loss and degradation within PAs from local to continental scales. They demonstrate that the effectiveness of forested PAs depends on the complex interplay between governance and management arrangements, socioeconomic factors, and anthropogenic pressures and threats. Ensuring effective forest protection, therefore, is vital for achieving global biodiversity and climate targets and for safeguarding local livelihoods.

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All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

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