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Editorial: Biodiversity conservation and sustainable development of protected areas

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Editorial on the Research Topic
Biodiversity conservation and sustainable development of protected areas

The Kunming-Montreal Global Biodiversity Framework adopted during the 15th meeting of the Conference of the Parties (COP) to the Convention on Biological Diversity (CBD) in 2022, calls for the effective protection and management of 30% of the world's terrestrial, inland water, coastal and marine areas by the year 2030 (30×30 target). Protected areas (PAs) are the most direct and effective initiative to conserve biodiversity (Maxwell et al., 2020), while increasing evidence shows that the services provided by intact and functioning ecosystems in PAs are also of great value to human livelihoods, health, and well-being (Fischborn and Sandwith, 2021). With the consensus on sustainable development worldwide, the balance between nature conservation and poverty eradication has become an inevitable choice. Therefore, biodiversity conservation and sustainable development within and around PAs has become a central topic to the field of conservation ecology.

Recent studies on biodiversity conservation in PAs have focused on key ecosystems and rare and endangered species, and explored the status and changes of these conservation targets (Wang et al., 2022). The relationship between management inputs and biodiversity outcomes of PAs have also attracted researchers in different countries (Geldmann et al., 2018; Feng et al., 2022). Furthermore, the effectiveness of PAs is often influenced by regional development, and PAs may also have positive or negative impacts on regional social and economic development (den Braber et al., 2018; Naidoo et al., 2019). Thus, it is urgent to integrate conservation in the sustainable development of PAs and their surrounding regions, and to explore strategies for promoting a harmonious model of human-land interaction while maintaining or enhancing the effectiveness of conservation efforts within these areas.

Here, we proposed the Research Topic, "biodiversity conservation and sustainable development of protected areas" featured in the "Conservation and Restoration Ecology"

section of Frontiers in Ecology and Evolution. This Research Topic aims to comprehensively explore the fundamental theories, technologies, approaches, and practices in the conservation of protected areas. Under this Research Topic, 11 articles have been successfully published with relevant findings, which provided useful insights.

a) The optimal spatial layout of PAs based on scientific methodology is an important issue in the establishment of PA system. That is, determining whether the location and scope of current PAs is reasonable, and making boundary and location adjustments are essential for effective conservation (He and Wei). Nogales et al. proposed a methodological framework for systematic conservation planning of freshwater ecosystems. He et al. explored an integrated optimization method applicable to PAs on islands.

b) The study on conservation status and effectiveness of PAs is to identify whether PAs can effectively protect the ecosystem and wildlife in the region (He and Wei). Shen et al. constructed an integrated framework through a series of assessments according to the state, trend, and relative change of each PA to explore the conservation effectiveness of PAs in the Three Parallel Rivers Region, China. Liu et al. found that climate and land-use changes would reduce the suitable habitats of Galliformes species in Southeast Asia and suggested establishing more PAs or adjusting the range of PAs based on the combined effect of climate and land-use changes. França et al. assessed the vulnerability to extinction of 55 snake species that occur in the Atlantic Forest of northeastern Brazil in Paraíba State, and found that only 18% of the snake fauna in this region is free of threats. They indicated that the fragmented habitats within some protected areas designated by the government were insufficient to support the survival of many animal populations, including snakes.

c) Exploring the relationship between conservation measures and changes of ecosystem in PAs is important to promote the effectiveness of PAs. Mndela et al. assessed the long-term impacts of shrub control on herbaceous vegetation and determined how wild ungulates modulate herbaceous vegetation response to shrub control. They suggested that the use of 50% shrub removal combined with wild ungulates is not only ecologically significant but also economically viable relative to 100% shrub removal. Zhang et al. studied the effects of rational clearcutting on the sprouting renewal of *Rhododendron* communities in one PA in Guizhou, China, and found that clearcutting improved the dominance of *Rhododendron* plants in the community and promoted sprouting renewal of *Rhododendron* populations. Another report used a molecular approach to investigate dietary flexibility of western red colobus (*Piliocolobus badius*) in two PAs with contrasting anthropogenic pressure (Aleixo-Pais et al.), with the aim to provide and implement sustainable and achievable conservation strategies within and around PAs.

d) The attitudes and perceptions of local communities are crucial for successful management of community-based conservation and sustainability of PAs. Xu et al. assessed the community perspectives of endangered species and the emotion and belief basis for participation in conservation in Sanjiangyuan National Park, China. They found that heterogeneity of preference was influenced by household income, religious beliefs, ethnicity, culture, and conservation awareness. Jones et al., analyzed the spatial distribution of perceived social impacts in 4 European Protected Areas and revealed that spatial proximity between local residents was the most important factors for predicting perceived impacts of PAs.

From these studies, we can conclude that the focus on conservation and management effectiveness of PAs has been a critical and welcomed step to achieve the 30×30 target. And how to take the most appropriate management measures, as well as how to keep the balance between biodiversity conservation and sustainable development of PAs and their surrounding regions, are crucial for enhancing the overall effectiveness of PAs. In conclusion, these studies promise to improve our knowledge of biodiversity conservation and sustainable development within and around PAs. We thank all authors who contributed to this Research Topic.

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