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Editorial: Wetlands: vulnerability and challenges of their management under climate change

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Editorial on the Research Topic

[Wetlands: vulnerability and challenges of their management under climate change](#)

Wetlands are diverse ecosystems worldwide: areas that are inundated or saturated with water, supporting typical biodiversity adapted to and dependent on water regimes and associated soils. They are part of wider hydrological systems and basins, playing a vital role in the hydrological cycle. They are considered natural harvesters of rainwater, acting as both sinks and sources, storing water for release over time through a complex interaction between surface and groundwater. Despite this importance, the world has lost about 50% of its wetlands since 1900 AD. Early recognition of the importance of wetlands led to the approval of the Ramsar Convention on Wetlands in 1971. Considering that the Ramsar Convention entered into force on December 21, 1975, the year 2025 marks 50 years of its implementation.

This Research Topic highlights the role of wetlands in ecosystem services, also alerting to their vulnerability to land use changes, anthropogenic disturbances such as pollution and sediment loads, and climate change. However, they can also become an opportunity to mitigate the effects of climate change, as recent studies have highlighted the critical role of wetlands in carbon sequestration.

The complexity involved in wetlands conservation is also representative of the modern challenge of an interdisciplinary view and understanding. This Research Topic aims to enhance knowledge about wetlands in their entirety—their complexity and vulnerability—as well as explore pathways to improve their protection, including environmental education and the recognition of their cultural value.

The Research Topic gathered six articles from different parts of the world, describing diverse wetlands in Africa, South America, Europe, and North America, from a range of different institutions: the University of Girona (Spain), la Universidad Nacional Autónoma de Huanta (Peru), the University of South Africa (South Africa), the Northumbria

University and the Natural England (United Kingdom), the University of Central Florida and the Florida Institute of Technology (United States of America), the University of Brasília, the Federal District Water, Energy and Sanitation Regulatory Agency, and the Tropical Water Research Alliance (Brazil).

The first article (Education about, in, and for Wetlands: Practices, Premises, Possibilities, and Challenges), by [Marcinkowski](#), is a review article encompassing areas of educational theory, research, and practice relevant to wetlands education. Besides a literature review of major curricular and instructional approaches worldwide and the broad instructional strategies available to and commonly used in wetlands education, the article retrieves goals and objectives for wetlands education from the Report of the Intergovernmental Conference on Environmental Education from the late 1970s. Initiatives, projects, and programs from federal agencies in the United States, along with their curricular and instructional materials, are analyzed in consideration of their connection to education about, in, and for inland and coastal wetlands.

The second article (Integrating education and conservation: a case study of the Huaper wetland), by [Morales et al.](#), presents the application of an experiential environmental education approach to wetland conservation, focusing on the Huaper Wetland (Peru). The research implemented hands-on educational activities and identified key factors influencing the effectiveness of educational interventions in wetland conservation, ultimately proposing four actionable conservation strategies that seek to integrate educational efforts with community priorities.

The third article [Deurbanizing for conservation and adapting: framing ecological restoration as a nature-based solution in La Pletera salt marsh, Catalonia (Spain)], by [Lindoso et al.](#), analyzes the case of de-urbanization and ecological restoration of La Pletera salt marsh (Catalan coast, Spain) using a nature-based solutions (NbS) approach and assessing the effectiveness of the Life Pletera project (2014–2018) as a strategy for climate adaptation and biodiversity conservation.

The fourth article (Progressing a river health assessment framework to tropical waters), by [Campos et al.](#), proposed an integrated framework based on two joint indexes, the Tropical Water Healthy Index (TWHI) and the Suitability of the Class of Use (SCU) as a contribution to water bodies management tools and models, encompassing rivers, lakes, and wetlands, based on a case study of the Melchior River stretch in Central Brazil. The TWHI corresponds to a river index that integrates pressures on aquatic ecosystems, their conditions, and societal and governmental responses, and SCU measures whether rivers' conditions are classified according to the proposed classes of use in the Brazilian water framework. The study demonstrates the simultaneous existence of problems with legislation and highlights the need for managerial actions.

The fifth article (Culture, climate, and landscape shape the savanna and wetland mosaic of the Bolivian Amazon), by [Whitney et al.](#), investigated the environmental archeology of the Bolivian Llanos de Mojos. The study, based on extensive archaeological, paleoenvironmental, and GIS datasets, investigated the historical use and management of wetlands within the broader Mojos mosaic landscape. The main findings indicated that the wetlands of the Llanos de Mojos are the result of millennia of human intervention

and that past human modifications of the landscape enabled the creation of a complex, managed wetland-terrestrial system for resource production, to which terrestrial crop production and agroforestry were integrated.

The last article of the Research Topic (Impact of climate change on Africa's major lakes: a systematic review incorporating pathways of enhancing climate resilience), by [Mutanda and Nhamo](#), performed systematic reviews on the literature to understand the impact of climate change on four major African lakes (Chad, Victoria, Tanganyika, and Malawi/Nyasa/Niassa) and to identify pathways for enhancing their resilience. The study found that climate change and extreme climate events are affecting these lakes in terms of their physical, chemical, and biological characteristics, leading to changes in lake levels, aquatic life, nutrient mixing, and the provision of ecosystem services. They also associated the ecosystemic impacts on the lakes with the socioeconomic activities and livelihoods that depend on these water bodies.

The set of articles on this Research Topic encompasses various issues related to conservation ecology and integrated water resources management, offering a broad, multidisciplinary perspective and an integrative view to better understand the diversity and complexity of wetlands in different parts of the world. Enjoy them!

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Conflict of interest

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