Journal of Environmental Biology
p-ISSN: 0254-8704 • e-ISSN: 2394-0379 • CODEN: JEBIDP

JEB®

Editorial
Volume 45 Issue 2 March 2024 pp. i-iv
DOI: *http://doi.org/10.22438/jeb/45/2/Editorial*

***J. Environ. Biol.*, 2024**

Journal website : www.jeb.co.in ★ **E-mail :** editor@jeb.co.in

2nd February 2024 – World Wetlands Day

Wetlands for human well-being

Wetlands, transitional lands bridging the gap between terrestrial and aquatic ecosystems, are among the most diverse and productive ecosystems, with biophysical interactions that provide numerous ecological, economic, and social benefits for human well-being.These vital ecosystems sustain ecological processes to provide services such as nutrient cycling, water purification, reducing pollution, carbon sequestration, groundwater recharge, flood reduction, erosion control, habitats for aquatic biota (Fig. 1), education opportunities, aesthetics, and recreation (Ramachandra *et al*., 2021; Ramachandra, 2022). In this context, World Wetlands Day is celebrated every year on 2nd February to raise global awareness about the vital role of wetlands for human well-being and commemorate the adoption of the Convention on Wetlands on 2nd February 1971 in the Iranian city of Ramsar. The Convention underscored sustainable and wise use of wetlands while advocating ecosystem approaches for the preservation of fragile ecosystems. Currently, 172 Ramsar Convention Contracting Parties and 2,500 Ramsar Sites totalling 2.5 million square kilometers are designated Ramsar Wetlands of International Importance. There are 80 wetlands of international significance in India (https://www.ramsar.org/) spanning 1,332,200 ha (which includes recently (on 31st January 2024) designated five wetlands - Ankasamudra Bird Conservation Reserve, Aghanashini Estuary (Ramachandra *et al*., 2018; Fig. 2) and Magadi Kere Conservation Reserve in Karnataka, and Karaivetti Bird Sanctuary and Longwood Shola Reserve Forest in Tamil Nadu). Pledged contracting parties advocate wise use of wetlands and water resources in the respective regions through national conservation plans, policies, legislation, management actions, and public education as per the tenets of 'seventeen Sustainable Development Goals (SDGs) of the United Nations to ensure sustainable water and land resource use, food and water security, biodiversity conservation, poverty alleviation, and climate change mitigation (https://sdgs.un.org/goals).

Fig. 1: Biodiversity of Bangalore wetlands

Wetlands are aptly known as the "kidneys of the landscape" because of their enduring ability to assimilate contaminants through soil and plants and ensure clean water for society. Biotic and abiotic constituents of wetlands perform physical, chemical, and biological functions that provide an array of services for human well-being (Ramachandra *et al*., 2016; 2023). Wetlands act as sponges in the landscape as natural reservoirs by allowing water infiltration during monsoons and providing water during post-monsoon periods (lean seasons). A significant hydrological function is the ability to lessen the peak intensity of floods through infiltration and retention, which helps to regulate water flow (Zedler and Kercher, 2005; Ramachandra, 2022). Emergent vegetation in wetlands regulates water flow and captures sediment-associated contaminants, including carbon, nitrogen, phosphorus, and heavy metals.

Wetlands are among the most productive ecosystems on Earth and provide a plethora of ecological services encompassing tangible and intangible benefits to sustain human livelihood and well-being (Clarkson *et al*., 2013;

Fig. 2: Aghanashini estuary - Ramsar wetland of International Significance

Ramachandra *et al.*, 2021). Appraisal of ecosystem services (ES) through compilation of provisioning services, regulating services, and cultural services allows for adjusted national accounts that reflect the output of ecosystem services as well as the depletion of natural resources and the degradation costs (externalized costs of the loss of ecosystem services) of ecosystems in economic terms (De Groot *et al.*, 2012; MEA, 2005; Ramachandra *et al*., 2021), which will help raise awareness and provide a quantitative tool to evaluate the sustainability of policies towards prudent management and conservation of fragile livelihoods supporting ecosystems (SEEA, 2021).

Global wetlands were estimated to be worth US$4.9 trillion annually (Costanza *et al.,* 1997). The value of provisioning, regulating, and cultural services provided by freshwater lentic ecosystems in Karnataka is 50, 197, and 38 billion rupees/year, respectively. The total ecosystem supply value (TESV) provided by the freshwater ecosystem of Karnataka is 285 billion rupees/year, and the net present value (NPV) amounted to 7321 billion rupees. Similarly, the value of services provided by the estuarine ecosystem in Karnataka is 5, 10, and 1 billion rupees/year from provisioning, regulating, and cultural services (Ramachandra *et al*., 2021; Ramachandra, 2022). The TESV provided by the estuarine ecosystem of Karnataka is 16 billion rupees/year, and the NPV amounts to 411 billion rupees. The total value of provisioning, regulating, and cultural services considering both freshwater and estuarine ecosystems was 55 billion Rs/yr (1,83,328 Rs/ha/yr), 207 billion Rs/yr (6,91,577 Rs/ha/yr), and 39 billion Rs/yr (1,30,686 Rs/ha/yr), respectively. The total ecosystem supply value of the Karnataka aquatic ecosystem was 301 billion Rs/yr (10,05,591 Rs/ha/yr), and the net present value amounts to 7,732 billion rupees, which highlights the ecological, social-cultural, economic, and environmental significance of wetlands (Ramachandra *et al*., 2021).

Wetland ecosystems, repositories of rich biodiversity, play a vital role in sustaining life on the Earth through the provision of food, fodder, and water apart from aiding as kidneys of a landscape (removal of contaminants), sequestering carbon, moderate micro-climate and mitigate detrimental consequences of floods and storms. These fragile ecosystems worldwide have been facing severe challenges due to unplanned developmental activities resulting in hydrologic regime changes, nutrient enrichment, land use changes, biodiversity loss, pollution, invasive species invasion, unsustainable resource use, and climate changes due to global warming. Nutrient enrichment leads to eutrophic conditions, lowering dissolved oxygen, which results in disruption of the aquatic food chain, as evident from the frequent occurrence of large-scale fish mortality, the profuse growth of invasive alien species, and pollution-tolerant species, affecting native biota and the livelihood of dependent local people (Ramachandra *et al*., 2020). Wetlands help maintain carbon balance through carbon sequestration in biota and soils. However, the degradation of wetlands leads to the release of a higher quantum of carbon dioxide (CO_2) into the atmosphere through breakdown of soil and vegetation carbon pools (Xu *et al*., 2018), which necessitates immediate mitigation measures to arrest wetland degradation or loss while acknowledging the significance of healthy wetlands for human well-being and the attainment of the SDGs (clean water, good health and well-being, zero hunger, alleviating poverty, climate action, gender equity, sustainable food production, and sustainable resource management).

The responsibility of maintaining intergenerational equity through sustenance of clean water, air, and the environment by ensuring ecological balance via sustainable management of natural ecosystems lies with the present generation. The 21st-century decision-makers need to recognize the crucial role of wetlands in securing food and clean water supplies and integrate ecosystem services through adjusted national accounts reflecting the ecosystem services as well as depletion of natural resources with degradation costs (externalized costs of the loss of ecosystem services), which will help in prudent management and conservation of ecosystems essential for human well-being.

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