Environment and Ecology 44 (2A) : 509—518, April—June 2026
Article DOI: https://doi.org/10.60151/envec/WUTZ4065
ISSN: 0970-0420 (Print), ISSN: 3049-3625 (Online)

Wetlands of Punjab: A Review on Current Status of Biodiversity, Threats and Management Strategies

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Received 28 April 2026, Accepted 21 June 2026, Published on 29 June 2026

ABSTRACT

Wetland ecosystems are dispersed across a wide range of climate and topographic conditions, and they provide a home to a wide variety of plant and animal life. They are extremely productive systems in their natural state, and they play a crucial role in the hydrological cycle. Wetlands are important because of the benefits they provide, such as irrigation, domestic supply, fishing, recharging aquifers, absorbing carbon emissions, preventing flooding and reducing pollution. In spite of its contribution, the water sector agenda hasn't paid nearly enough attention to the management of wetlands. The impact of urbanization industrialization and agricultural operations on wetlands results in substantial and significant problems, such as the reduction of wetland areas and ecological imbalance, among others. Several institutions, organizations, and Governmental authorities on the national and international levels have presented provisions for the conservation of wetland areas in an effort to comprehend and evaluate the threat and severity of wetland regions. Agriculture expansion, industrialization, and urbanization pose serious challenges to the wetland ecosystems of Punjab. As a result, wetland ecosystems need to be managed and conserved in order to be used in the present and the future in a sustainable manner. The purpose of this review is to highlight the distribution, status and ecological importance of wetlands in Punjab with particular attention to Ramsar sites and major wetland ecosystems of Punjab. The study evaluates the main anthropogenic drivers threatening these wetlands (urbanization, industrialization, agricultural expansion) and reviews existing conservation/management strategies with a view to promoting their sustainable use and long-term protection.

Keywords Importance, Threats, Management, Punjab, Sustainability and wetlands.

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INTRODUCTION

One of Earth's most abundant ecosystems is the wetland (Ghermandi *et al*. 2008). They supply a large

array of ecosystem goods and services in addition to supporting a huge variety of species. They are also adaptive systems that are responsive to the environment (Turner *et al.* 2000). Wetland ecosystems are highly diverse in terms of their source, geography, hydrological regime and composition, dominant species, and soil and sediment characteristics (Seenivasan 2013). Wetland ecosystems cover between 917 million hectares (m ha) and more than 1275 million hectares (m ha) of land worldwide, with an estimated yearly economic value of over US$15 trillion (Gries and Schneider 1995; Lehner and Döll 2004). According to the Ramsar Convention, the majority of India's natural water bodies, including rivers, lakes, coastal lagoons, mangroves, peat bogs, and coral reefs, as well as man-made wetlands, including ponds, farm ponds, irrigated fields, sacred groves, salt pans, reservoirs, gravel pits, sewage farms, and canals, are considered to be part of the wetland ecosystem. These enormous wetland areas only comprise 26 Ramsar Sites (Ramsar 2004). However, other, potentially more beneficial, wetland services are being ignored when creating policy. Numerous freshwater wetland ecosystems are threatened by urbanization, population development, and increased economic activity, and many of these ecosystems have already been degraded and lost (Board, CPCB 2008). The state of Punjab has 1381 wetlands with an area greater than 2.25 hectares, covering an area of 81234 hectares, with 24286 hectares under water during the pre-monsoon season and 36344 hectares under water during the post-monsoon season, according to the MoEF&CC's 2010 National Wetlands Inventory Assessment report for Punjab (Space Applications Centre 2011). Additionally, there are 5049 wetland areas comprising 5049 hectares, each measuring less than 2.25 ha in size. The 6430 wetland areas of the state collectively cover 86283 acres. This consists of 17160 ha of pre-monsoon aquatic vegetation and 15920 ha of post-monsoon aquatic vegetation. The report classifies wetland areas larger than 2.25 hectares into many groups, with "riverine/stream" wetlands (151 in number and 59864 ha in area) including the biggest wetland area.

Ramsar convention

The Ramsar Convention is a global agreement for the protection and wise use of wetlands. It acknowledges the ecologically important roles that wetlands play as well as their significance for business, culture, science, and recreation. In the late 1960s, Eskandar Firouz, a former Iranian environment minister, Luc Hoffmann, director of the Tour du Valat research station in the French Camargue, and Geoffrey Matthews, director of the Wildfowl & Wetlands Trust at Slimbridge, founded the conference. On February 2, 1971, the meeting in Ramsar, an Iranian resort town on the Caspian Sea, adopted the agreement's terms. In 2021, the convention will turn 50. World Wetlands Day, observed on February 2, commemorates the adoption of the convention (Bridgewater and Kim 2021). WWD was first observed in 1997 with the goal of increasing public awareness of the importance of wetlands for both people and the environment. Since then, it has become a yearly event. In 2015, 59 nations observed World Wetlands Day.

Distribution and extent of wetlands in punjab according to their importance

Punjab has given birth to one of the largest wetland systems of north-west India. Wetlands in the state consist of river floodplains, reservoirs, oxbow lakes, marshes, and village ponds, and are mostly related to the Sutlej, Beas, Ravi and Ghaggar river systems. Punjab has more than 1,300 large wetlands and thousands of smaller wetlands covering an area of approximately 86, 000 hectares or almost 1.7% of the geographical area of the Punjab as per the National Wetland Atlas of India (SACON and ISRO 2011). On account of their biologically significance and conservation status, these wetlands are ordered as wetlands of worldwide significance, national significance, state significance and different recognized wetlands.

Wetlands of international importance (Ramsar Sites)

There are currently six Ramsar Sites (wetlands of international importance) in Punjab, which have been recognized under the Ramsar Convention on Wetlands (Table 1). These comprise Harike Wetland, Ropar Wetland, Kanjli Wetland, Nangal Wildlife Sanctuary, Beas Conservation Reserve and Keshopur-Miani Community Reserve (Figs. 1, 2).

Table 1. Ramsar sites in Punjab.

Sl. No.	Name of wetland	District boundaries	Area (Hectare)	Coordinates	Primary inflows	Date of declaration	Type of wetland
1	Harike Lake	TarnTaran,Ferozepur & Kapurthala	4100	31°15'N 74.97'E	River Beas and Satluj	23 March 1990	Man-made wetland
2	Kanjli Lake	Kapurthala	184	31.42' N 75°37' E	Kali Bein rivulet	22 January 2002	Man-made wetland
3	Ropar Lake	Ropar	1365	31°02' N 76°50' E	River Satluj	22 January 2002	Man-made wetland
4	Keshopur-Miani Community Reserve	Gurdaspur	344	32°05' N 075°23'E	River Beas and Ravi	26 September 2019	Natural
5	Beas Conservation reserve	Hosiarpur, Amritsar, Jalandhar, Kapurthala Gurdaspur and Tarn taran	6429	31°23'N 075°11' E	River beas	26 September 2019	Man-made wetland
6	Nangal Wildlife Sanctuary	Ropar	116	31°23' N 76°22' E	River Satluj	26 September 2019	Man-madewetland

The Harike Wetland, largest wetland in Punjab, was designated in 1990 and provides an alternative habitat for migratory birds entering the Central Asian Flyway. The Ramsar designated wetlands have exemplary biodiversity, ecosystems and global significance for conservation (MoEFCC 2025). These sites are important for supporting many species of fish, reptiles, mammals and waterbirds, as well as regulating floods and recharging groundwater.

Wetlands of national importance

Few Wetlands in Punjab were identified for various important ecological and hydrological functions under the National Wetland Conservation Program (NWCP). These include Harike, Ropar, Kanjli, Nangal-barrage Wetland and Ranjit Sagar Wetlands. National level conservation measures include habitat restoration, pollution control, biodiversity monitoring and sustainable management of resources. These wetlands are known for their significance in contributing to water security, fisheries and biodiversity conservation of Northern India (MoEFCC 2024).

State wetlands

Besides nationally important wetlands, the Punjab State Wetlands Authority has identified a few

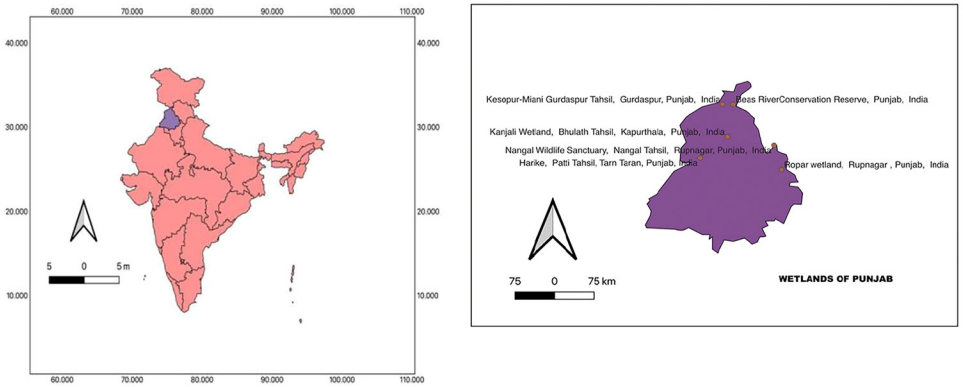


Fig. 1. a) Map of India representing Punjab. b) Representing the distribution of wetlands in Punjab.

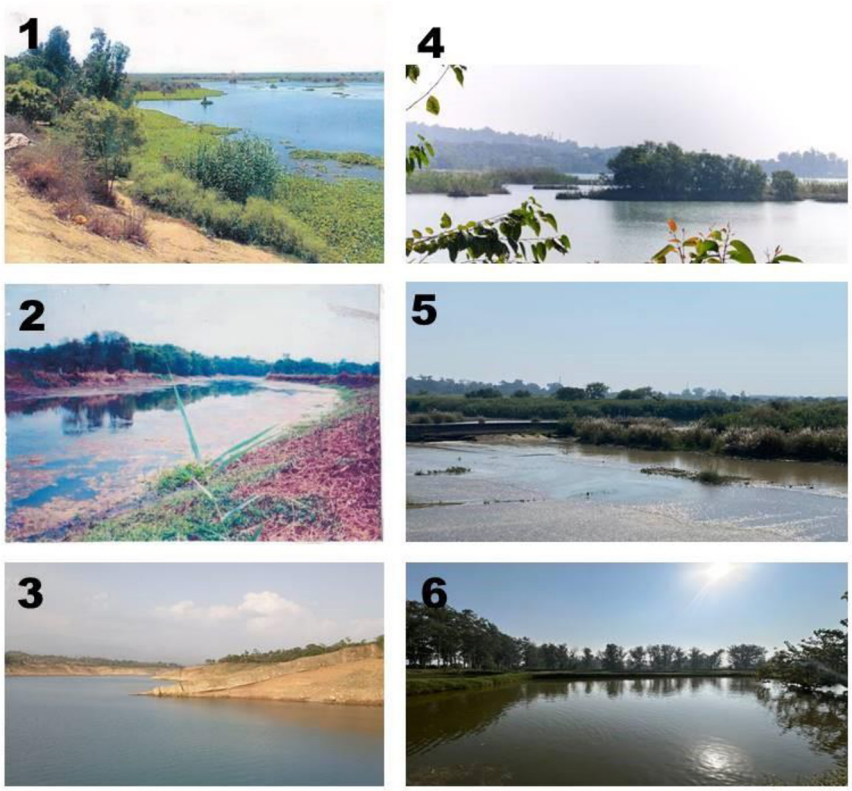


Fig. 2. i. Harike Wetland, ii. Kanjli Wetland, iii. Ranjit Sagar Wetland, iv. Nangal Wetland, v. Ropar Wetland, vi. Keshopur Wetland.

state-dominant wetland locations. Noteworthy examples of resources are Ranjit Sagar Wetland, Beas Wetland and Keshopur-Miani Wetland. Weaker for wetland conservation Management Of Wetlands in Punjab as has been Enhanced By preparing of management Plans & notification of Additional Wetlands Under sqm the conditions laid down under the Wetlands (Conservation and Management) Rules, 2017 by Formulation. Although a few additional water bodies are proposed under law (Punjab State Wetlands Authority 2025), the increasing focus on conservation of wetlands at the state level.

Other identified wetlands

Apart from the important wetlands, hundreds of other smaller wetlands have also been documented in Punjab such as the village ponds, marshes, seasonal floodplain wetlands, reservoirs and oxbow lakes. While they may not be nationally or internationally recognised, these wetlands support vital ecosystem services including groundwater recharge, irrigation, livestock watering, fisheries production and local biodiversity conservation. Also an important habitat to a lot of birds which feed and rest here in migratory times. Due to their cumulative ecological and socio-economic importance, the new inventories for wetlands have witnessed a focus towards conserving these smaller lifelines (National Wetland Atlas 2011) (Tables 2, 3).

The ancient Punjab had a huge wealth of wetlands, as its name suggests (Punj, which means five, and Aab, which means rivers, make up the name). In Punjab, natural wetlands made up roughly 60,000 ha, or 1.32% of the land, until the 1950s. Currently, 0.46% of Punjab is covered with wetlands. Wetlands larger than 10 ha cover approximately 15000 ha. Before the early 1960s, man-made wetlands covered an area of 6500 ha; today, they occupy about 8000 ha.

Table 2. Wetlands of Punjab State.

Sl. No.	Name of wetland	District boundaries	Area (Hectare)	Type of wetland
1	Jastarwal Jheel	Harcha Chinna block near Ajnala town in Amritsar	135	Natural wetland
2	Kahnuwan	Gurdaspur	122	Natural wetland
3	Keshopur Miani jheel	Gurdaspur	344	Natural wetland
4	Mand Bharthala	Nawanshahr	150	Natural wetland
5	Dholbhaha reservior	Hoshairpur	132	Man-made wetland

The current Indian Punjab is 50362 km^2 in size and may be found between 29° 320° North and 74° 770° East. Currently, wetlands cover less than 1% of the land area.84% of the area is under cultivation, and 5.7% is covered by trees (Ladhar 1995) It's typical subtropical climate features hot summers (with temperatures as high as 47°C in some places) and mild winters (with a low around 0°C). In lowland regions, the annual rainfall average is 532 mm, whereas, in Northern sub-mountain regions, it is 890 mm. The overall population of 24.29 million people has experienced an amazing population increase, and about 70% of them are dependent on agriculture. The population density, which is 482 people per km^2, is significantly higher than the national average. In such circumstances, Punjab has consistently lost wetlands. Three more wetlands have been recognised as Ramsar sites of international significance thanks to the Punjab government's efforts. Three wetlands in the state already have Ramsar tags: Harike (1990), Kanjli (2002), and Ropar (2002). Three more are now available: The Keshopur Miani Wetland, the Nangal Wildlife Sanctuary, and the Beas Conservation Reserve. The administration put forward a total of five locations for Ramsar tags in October 2019, including the Hussain Wala wetland and Ranjit Sagar conservation reserve. The Keshopur-Miani Community Reserve, the Beas Conservation Reserve, and the Nangal Wildlife Sanctuary are the new wetlands chosen for the tag. As a result, the state's six wetlands are now protected by the Ramsar treaty.

Table 3. Other identified wetlands.

Sl. No.	Name of wetland	District boundaries	Area (Hectare)	Type of wetland
1	Aliwal Kotli	Amritsar	25	Natural wetland
2	Bareta	Mansa	50	Natural wet - land
3	Narayangarh Terkiana	Hoshiarpur	200	Natural wetland
4	Rababsar	Kapurthala	100	Natural wetland
5	Lahail Kalan	Sangrur	50	Natural wetland
6	Gobindgarh Khokhar	Sangrur	20	Natural wetland
7	Sital Sagar Mansar	Hoshiarpur	2000	Natural wetland
8	Lobana Nabha	Patiala	28	Natural wetland
9	Kistowal Kistowal/Patti	Amritsar	28	Natural wetland
10	Goindwal Sahib (Tarn Taran)	Amritsar	20	Natural wetland
11	Hussainiwala	Ferozepur	688	Man-made wetland
12	Maili Dam Maili	Hoshiarpur	72	Man-made wetland
13	Mangrowal Dam	Hoshiarpur	70	Man-made wetland

(A) Harike Lake

Harike Wetland is one of northern India's major freshwater wetlands. It was designated a Ramsar site in 1990 and is one of six in India. This is a man-made, riverine wetland established as a result of the barrage's construction in 1952. It is located at the confluence of two important rivers in Punjab, the Sutlej and the Beas, and is divided into three districts: Kapurthala, Tatantaran and Ferozepur. In

1987–88, the Ministry of Environment and Forests of the Government of India recognised the importance of the Harike Ecological Zone, and since then, many implementing departments have conducted conservation and management projects (e.g., forest, wildlife, fisheries, irrigation, soil conservation, state pollution control boards, town and country planning, and universities). Punjab State Council for Science and Technology (PSCST) is the nodal agency for this and other wetlands conservation and management. Harike Wetland has a total area of 41 km^2 and has been surveyed both on the ground and using remote sensing equipment. According to the ground survey conducted by the Irrigation Department, 2795.14 ha of the total area of 3713.76 ha surveyed is under water. This ecologically significant wetland serves as a strategic reservoir for providing irrigation and drinking water supplies to Punjab and Rajasthan via feeder canals in Ferozepur and Rajasthan, with a total carrying capacity of 29000 cusecs (Ladhar 1995). It is also an extremely rich biodiversity center. There are 360 species of birds, 16 taxa of fish, 7 taxa of turtles, 6 taxa of amphibians, 4 species of snakes, 189 taxa of invertebrates, and 38 taxa of plants may be found in Harike.

B) Kanjli Wetland

This wetland, known as Village Kanjli, is located about four kilometers from Kapurthala town and is nourished by Kali Bein, a tributary of the Sutlej (formerly Beas) that flows from its source near the village of Dhanoa in the Hoshiarpur district and joins the river upstream of Harike Reservoir. This wetland, which covers an area of roughly 490 ha with a water spread of 184 ha at 31°42' North latitude and 75° 37' East longitude, was added to the list of wetlands of national importance in 1988. Water can be up to 25 feet deep here. This wetland is significant from a religious and recreational perspective, as well as for the many species of fish it fosters, the hydrological regime it maintains, and the variety of avifauna it provides shelter for. Nonetheless, water hyacinth proliferation, pollution, diminished water flow, encroachment, and harvesting all pose threats. Research funded by the PSCST has found significant seasonal differences in water quality (Punjab Pollution Control Board 1999). According to the authorized best-use classification, the water quality is normally Class "B" except at one site in December, where it drops to Class "D." Over-exploitation of groundwater supplies and a decline in waterflow threaten the Kanjli Wetland as a result of large-scale Kali Bein scaling at its higher terminal end and subsequent use for agricultural purposes. Due to the Mukerian Hydel Channel's diversion of Beas water, groundwater recharge from the Beas has substantially decreased, resulting in a decrease in oozing out of the water near the villages of Dhanoa, Himatpur, and Vadhaya in the Hoshiarpur district. Monitoring the groundwater balance of these settlements and acting accordingly, such as by reopening the Budhu Barkat regulator and preventing the diversion of the upper section of Kali Bein into the Beas, is necessary in order to keep water levels in Kali Bein at an acceptable level.

C) Ropar Wetland

Ropar Wetland has an expansive area of 1365 hectares. In 1952, the Ropar Barrage was built over the Sutlej River to redirect water into the Sirhind Canal and the Bist Doab Canal (Kumar and Singh 2020). The ecological and hydrological functions of this wetland are crucial, but it also has considerable potential for fisheries, forestry, agriculture, horticulture, wildlife, and recreation (MoEF 2008). The scaly

anteater and a variety of other endangered species rely on this one-of-a-kind wetland nestled in the Shivalik Foothills. There have been reports of 119 different bird species and 20 different fish species in this particular swamp (https://en.wikipedia.org/wiki/Ramsar_Convention). This wetland was designated as a wetland of national importance by the Ministry of Environment and Forests, Government of India, in 1992, due to its high ecological value. According to the IUCN Red List, the marsh is home to both the critically endangered Chitra indica turtle and the threatened Python molurus ("at reduced risk").The Ramsar Convention has classified Ropar Wetland (also listed as Ropar Lake) as one of the Ramsar sites in 2002 and declared a wetland of national importance in 1996. This was done for "the protection of world biological diversity and for maintaining human existence through the ecological and hydrological services they serve," according to the convention's website. Ropar Wetland is home to a wide variety of plant and animal species, making it a key prospect for inclusion in the Ramsar list.

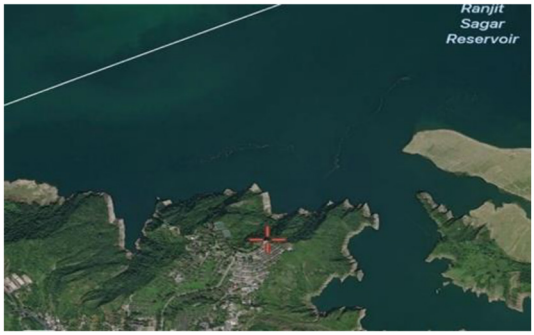
D) Nangal Wetland

The Nangal wetland and Nangal wildlife sanctuary is located 100 Km from Chandigarh. It is located 31◦37' N 76◦23'E at an elevation of 326 m above mean sea level. The wetland is situated in the Shiwalik foothills of Punjab. This manmade water reservoir is built as a part of Bhakra-Nangal Project. (Table 4) This balancing reservoir was built in the Ropar district in 1961 as a component of a significant hydroelectric project to supply irrigation water and electricity to remote areas, including sections of Punjab and Haryana. From social, ecological, hydrological, and recreational perspectives, this reservoir is crucial. This lake supports a variety of local bird, fish, reptile, and plant species in addition to acting as a crucial refuelling hub for migrating avifauna. This wetland is home to 154 different bird species, according to reports. This wetland was designated a national wetland in January 2008 and covers an area of 400 ha due to its unique habitat. It was regarded as Ramsar site in September 2019.

E) Beas conservation reserve: Beas conservation reserve is a stretch of 185 km along the banks of Beas River. This conservation reserve is spread from the Himalayan foothills to the Harike headworks. It is located 31◦23' 40" N 75◦11'40" E at an elevation of 210-320 m above mean sea level. This reserve has diverse kind food chains and food webs and supports abundant biodiversity. The presence of sand bars, islands and braided channels along the length of Beas River creates a complex ecosystem.

The average depth of water varies from 1.5 m during dry months to 4.5 m during the rainy months of the year. Beas conservation reserve was given status of Ramsar site in September 2019.

A) Ranjit Sagar



Ranjit Sagar is an interstate wetland spanning three states (Punjab, Himachal Pradesh, and J&K) and is situated on the river Ravi approximately 24 kilometres upstream of the Madhopur Headworks in Gurdaspur district (Table 4). It is an artificial riverine and lacustrine wetland with a freshwater ecology. It is located at around 540 msl, 32° 26' 30" N latitude, and 75° 43' 30" E longitude, and is 87.60 km^2 in size (https://en.wikipedia.org/wiki/Ramsar_Convention). The reservoir encompasses portions of the states of Punjab (3%), Himachal Pradesh (82%), and Jammu

Table 4. Wetlands of National importance.

Sl. No.	Name of Wetland	District boundaries	Area (Hectare)	Coordinates	Primary inflows	Date of declaration	Type of wetland
1	Nangal lake	Ropar	400	31°22N 76°23 E	River Satluj	10 Aug 2009	Man-made wetland
2	Ranjit Sagar	Basholi and Pathankot	8760	32°26 N 75°43 E	River Ravi	March 2001	Man-made wetland

and Kashmir (15%). In 2006, at the request of the Honorable Governor of Punjab, the Ministry of Environment and Forests of India included Ranjit Sagar in its national wetland protection program. The primary functions of the reservoir formed by the construction of the dam are irrigation, flood control, power generation, and water supply. In comparison to other wetlands in Punjab, it is Coldwater Wetland, with a larger catchment area.

Importance of wetlands

The rivers and marshes serve as civilization's arteries and transition zone, respectively (Solanki and Joshi, 2017). Wetlands are important for aquatic life because they protect the shoreline from erosion, recharge groundwater, reduce the amount of carbon dioxide in the environment through a process known as carbon sequestration, maintain the health of mangroves, reduce flood levels during periods of flooding, attract more nutrients and suspended solids to lakes than if they flow directly into the lakes, improve water quality, and enhance the aesthetic appeal of the environment. They aid industries economically by serving as nurseries for fish and other aquatic foods and vegetation.

Growing threats to wetlands

1) Excessive weed infestation: Excessive proliferation of macrophytes and weeds such as water hyacinth (*Eichhorniacrassipes*), *Nelumbium*, and *Trapais* a significant danger to aquatic biodiversity which is due to discharge of wastewater through Buddha Nallah from catchment towns and industrial sources.

2) Siltation: The pond's surface area has been decreased by the deposition of silt eroded from nearby catchment areas and distant hill catchments. Attacks brought on by demographic processes are exacerbated by the siltation of man-made wetlands caused by erosion from denuded neighboring catchments, which are also subject to a variety of threats like agriculture and grazing.

3) Grazing: Unchecked grazing in wetland catchments threatens their ecology by generating soil erosion and habitat loss.

4) Reduced inflow: In order to reduce eutrophication, the flow of water entering the wetland must be increased. Due to intensive and contemporary farming practices, there is a decrease in the amount of water that enters the nearby agricultural uplands and natural wetlands. As a result, many of them are now terrestrial environments and are vulnerable to agricultural invasion.

5) Encroachment: The threat to wetlands' biodiversity is posed by encroaching agricultural land. A lot of pressure is being used to encroach on the wetland.

6) Land use and urbanization: Filling up low-lying areas with soil from other places to make them productive. Wetlands that are smaller and shallower are more susceptible to this approach.

7) Pollution from industrial effluent and agricultural runoff: Ecosystems are disturbed when domestic and industrial effluents and solid wastes are carelessly dumped into low-lying areas, public spaces, streams, and rivers.

8) Tourism: Wetland ecosystems have seen substantial changes as a result of the public's generally negative perception of wetlands, which are seen as free "gifts" of land and an opportunity to exploit the resources.

9) Use of agro chemicals: The influx of pollutants

from adjacent towns and agricultural runoff caused by excessive use of agro-chemicals causes eutrophication, which reduces the inflow of water currents into the wetland and has an impact on the associated flora and fauna.

10) Short-term benefits: Lowlands are drained and converted into crops for agriculture or other short-term benefits. Uncontrolled consolidation and reconsolidation have provided owners or beneficiaries unrestricted access to reclaim wetland areas.

Management strategies adopted for wetland management:

1) Weed check: A combination of manual, mechanical, and biological treatments have been used to control water hyacinth at the Harike and Kanjli Wetlands. At the Harike Wetland, the effects of biological agents from *Neochetinaeichorniae* and *N. bruchi* have shown good results. But the procedure moves quite slowly. It has been shown to be beneficial to use a mechanical system that includes motorised winches and a conveyor belt system.

2) Fencing strategy: 7317 running metres of fencing at Harike and 3354 running meters of fencing at Kanjli Wetland have been built in key spots to avoid interference and check encroachment on the wetland area.

3) Encroachments free areas: Encroachments have been removed from 169 ha of the Harike Wetland and 8 ha of the Kanjli Wetland, which were formerly populated by unlicensed people. These regions are being prepared for the planting of local tree species like mainly *Acacia,Terminalia, Eugenia, Salix, Melia, Ficus* and *Zizyphus.*

4) Geographical Information system: The major goal of developing this system is to create an appropriate program for wetlands that will make it simple to keep track of both past and present activities, plan future steps for wetlands conservation and management, and graphically display all the data.

5) Soil conservation and management: In order to conserve the soil, actions have been taken in some of the key catchment regions of the Harike Wetland, such as planting trees, erecting vegetative structures, staggered trenching, terracing the ground, and installing small gully plugs.

6) Water quality surveillance: Research on Harike Wetland's water quality reveals that for most of the year, it normally complies with Class "A" standards. The water quality of Kanjli Wetland is Class "B" compliant. But occasionally it drops to class "D." In general, RoparWetland's water quality complies with Class "A" standards.

Other management strategies includes:

1) Assessing the local wetland values to make sure that planning decisions are founded on a thorough understanding of the benefits of wetlands and their socio-economic repercussions.

2) Supporting wetland research in the network program's designated area in order to comprehend how wetland systems work and efficiently utilise the advantages of future monitoring and research initiatives.

3) Evaluating the management potential of the region's wetland systems for sustainable activities and rational exploitation levels.

4) Increasing institutional competence through training and capacity-building initiatives.

5) Effective adoption or application of the current legislative regulations under the Land Acquisition Act, Panchayat Acts, Wildlife Act, Environment Acts, etc. that incorporate significant wetlands within the administrative unit.

6) Strengthening general management practises and continuing management measures.

CONCLUSION

Wetlands are regarded as having distinctive ecological characteristics that provide several goods and services to humankind. Wetlands primarily provide irrigation water, fisheries, non-wood forest products, water supplies, and recreational opportunities. The most important services include carbon sequestration,

flood management, groundwater recharge, fertilizer removal, toxics retention, and biodiversity preservation. The impacts of urbanization and agricultural activities contribute to a significant reduction in land area and ecological disruption. There is a need to comprehend the issue and its seriousness. Conservation and management of these resources are required for the environment's and ecosystem's balanced growth. Relevant government agencies must work closely with local universities, educational institutions, individual experts, and non-governmental organizations (NGOs) on subjects of mutual interest so that wetland protection progresses beyond mere rhetoric. Finally, it is important that the perspectives of knowledgeable local community representatives be heard and included in future policies and plans so that management action plans can be implemented efficiently.

REFERENCES

Board, C. P. C. (2009). Status of water supply, wastewater generation and treatment in Class-I cities and Class-II towns of India. Central Pollution Control Board, Government of India New Delhi, India.

Bridgewater, P., & Kim, R. E. (2021). The Ramsar Convention on Wetlands at 50. Nature Ecology & Evolution.

Ghermandi, A., van den Bergh, J. C. J. M., Brander, L. M., de Groot, H. L. F., & Nunes, P. A. L. D. (2008). The economic value of wetland conservation and creation: A meta-analysis.

Gries, D., & Schneider, F. B. (1995). Avoiding the undefined by underspecification. Computer Science Today, 366—373.

Kumar, G., & Singh, K. K. (2020). Mapping and monitoring the selected wetlands of Punjab, India, using geospatial techniques. *Journal of the Indian Society of Remote Sensing*, 48 (4), 615—625.

Ladhar, S. S. (1995). Inventory and Ecological Status of Wetlands and Lake Ecosystems of Punjab. PSCST Document. Chandigarh.

Lehner, B., & Döll, P. (2004). Development and validation of a global database of lakes, reservoirs and wetlands. *Journal of Hydrology*, 296 (1), 1—22. https://doi.org/https://doi.org/10.1016/j.jhydrol.2004.03.028

Ministry of Environment, Forest and Climate Change (MoEFCC). (2025). Ramsar Sites in India. Government of India, New Delhi.

Ministry of Environment, Forest and Climate Change (MoEFCC). (2024). Wetlands Conservation and Management Program. Government of India.

MoEF. (2008). Punjab Environment: Status Report, 1995. In:Conservation of WeU.Ands in Lndia:AProfile (Approa()"l and Guidelines). Published by Minis.Tty of Enviroriment & Forests Government of Fn (Fia,NewOelhL).

Punjab State Wetlands Authority. (2025). Wetland Conservation and Management Initiatives in Punjab.

Ramsar Convention Secretariat. (2025). The List of Wetlands of International Importance (Ramsar Sites). Gland, Switzerland.

Ramsar, C. (2004). The list of wetlands of international importance. RAMSAR Secretariat: Gland, Switzerland. Ropar. Ramsar Sites Information Service. Retrieved 25 April 2018.

Seenivasan, R. (2013). National Wetland Atlas of India: A review and some inferences. *Economic and Political Weekly*, 120—124.

Solanki, V., & Joshi, A. (2017). Disappearing wetland: A study of Basai wetlands, Haryana (India). *International Journal of Economic Research*, 14(21), 159—169.

Space Applications Center (SAC), ISRO & Salim Ali Center for Ornithology and Natural History (SACON). (2011). National Wetland Atlas: Punjab. Ahmedabad, India.

Space Applications Center (SAC). (2011). National Wetland Inventory and Assessment: Punjab (NWIA Atlas). Ahmedabad, India: Space Applications Center, Indian Space Research Organisation (ISRO), Ministry of Environment and Forests, Government of India.

Turner, R. K., van den Bergh, J. C. J. M., Söderqvist, T., Barendregt, A., van der Straaten, J., Maltby, E., & van Ierland, E. C. (2000). Ecological-economic analysis of wetlands: Scientific integration for management and policy. *Ecological Economics*, 35 (1), 7—23. https://doi.org/https://doi.org/10.1016/S0921-8009(00)00164-6