

CONSERVATION OF URBAN WETLAND WITH POTENTIAL INTERNATIONAL SIGNIFICANCE: A CASE STUDY ON NAJAFGARH JHEEL, DELHI, INDIA

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Abstract

Urban lakes, or jheels, are essential ecological elements that help maintain ecosystem services such as groundwater, regional climate, and biodiversity. The continuous urban sprawl and population growth in urban areas are essential factors in the decline of freshwater bodies. However, these ecosystems have functional advantages. The National Capital Region of India has a population of 46 million and is situated on the Yamuna watershed. The resilience plan for the city requires research on hydrological sustainability. The present study focuses on the case study of Najafgarh Jheel, a trans-boundary lake that has recently received the status of a water body under the wetland rules of 2017 of India by the National Green Tribunal after 215 years of existence and deterioration. The primary data collection was through field visits of avifauna data, and secondary data from eBird data, research articles, government reports, and newspaper articles have been the main tools for analysis. The baselines of international significance for Najafgarh Jheel were compared to criteria laid out by the Important Bird and Biodiversity Area Programme and the Ramsar Convention. The Najafgarh Jheel area could be a prospective wetland of international significance for its ornithological significance. The Jheel is facing several anthropogenic stressors with an urgent need for protection and demarcation under the protected area network.

Keywords: Waterfowl; Conservation and Management; Urban Lake; Protected Area Network

Introduction

Wetlands are fragile ecosystems [1] that provide several vital ecological services and play a very important role in sustaining biodiversity [2, 3]. However, wetlands are diminishing worldwide [3, 4]. In a study that reviewed 189 reports and quantified wetland changes around the world, an estimated 54-57% of wetlands have been lost. The rate of loss has been 3.7 times higher in the 20th and 21st centuries. Further, it was observed that inland wetlands have a faster rate of loss when compared with coastal natural wetlands [5]. The 2011 National Wetland Inventory Assessment estimated that Delhi would have lost 25% of the water bodies in comparison to the assessment taken in 1998. The actual surface reduction in area was 1.76sqkm, with only 450 water bodies surviving out of 1040 listed by the Delhi Parks and Gardens Society. The remaining 590 water bodies were either polluted, dried, or encroached upon [6]. The water quality index of four wetlands in Delhi demonstrated poor to unsuitable conditions for consumption [7].

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The natural health of all water bodies is necessary and important because they support a range of social and economic activities. These can be sustained if water bodies are protected or restored in their natural environment [8-15].

Surface water bodies such as lakes, ponds, and reservoirs play a vital role in linking groundwater demand with its natural availability by storing rainwater, the water flow of rivers, etc. Although some bodies of water are quite abundant, due to poor management, their number is decreasing. This aspect leads to low penetration of water into the ground and depletion of the water table. If we identify the specific water requirement for a healthy ecosystem in its original form, then efficient water management can be planned. This can be achieved by restoring lakes, ponds, and reservoirs by increasing their water storage capacity and maintaining the water source throughout the year [16–21].

The districts of Gurugram in Haryana and Southwest Delhi have been facing severe water scarcities due to depleting groundwater and growing demand. The Central Ground Water Board has classified these areas as critically overexploited and dark zones [22, 23]. Keeping water bodies safe and well-maintained is therefore important to the long-term viability of these regions.

One aspect is that the decline of stop-over habitats affects wintering and breeding, which would gradually lead to increased rates of population decline [24, 25]. The wetlands used for migration are important for the resting of migratory birds, and their decline could have an impact on the migratory communities [25, 26]. The other aspect is that wetland biodiversity has an ecological role in wetland ecosystem functioning [25]. Therefore, the conservation of wetland biodiversity requires an effective management strategy and guidelines. The guidelines on the conservation of wetland biodiversity for regional importance are under the Important Bird and Biodiversity Area (IBA) programme. The IBA programme under Birdlife has the goal of recognising and protecting globally significant areas for the avian life cycle and conserving them through networks of institutions [27]. India currently has 467 IBAs, with 40% of these not falling under protected area (PA) networks. The IBAs are considered an important tool for landscape-level conservation planning [28]. The international importance of the wetland biodiversity conservation guidelines is provided by the Ramsar Convention. India has 49 Ramsar sites [29]. Interestingly, the two sites added in 2021, Bhindawas Wildlife Sanctuary and Sultanpur National Park in the state of Haryana, are in close proximity to Najafgarh Jheel. The deterioration of urban wetlands and events of rapid decline of stop-over habitats would result in migratory waterfowl congregating on the remaining wetlands, resulting in increased mortality as the carrying capacity would be exceeded [30]. Therefore, it is imperative to delineate and quantify potential sites for designation under regional and international guidelines such as IBAs and the Ramsar Convention.

Compliance Status under the Wetland (Conservation and Management) Rules 2017 mandate submitted to the National Green Tribunal disclosed that Delhi has enumerated 1040 wetlands with 16 accountable agencies. According to the Delhi State Wetland Authority (DSWA), only 18 of these water bodies are protected, with 5 classified as significant wetlands. Brief descriptions were prepared for only 539 of the listed water bodies and placed under technical review. Whereas, in Haryana, the pond authority has listed 18000 ponds, and of these, the Haryana State Wetland Authority (HSA) has listed 1216 water bodies that would be under them. Confirmation that these ponds and water bodies have been listed under the revenue records was still under process until August 2021 for both state governments. Haryana has listed only three water bodies as significant and is developing an Integrated Management Plan and brief description, including Najafgarh Jheel. Further, Haryana has given 54 pounds to corporations under the corporate environment responsibility fund [31]. The DSWA has received a request from the Delhi Development Authority (DDA) and Delhi Jal Board (DJB) to remove 221 water bodies from the official list, citing development and completed structures. It was also

mentioned that 37 water bodies tagged by DSWA were not traceable due to inadequate block numbers or geo-coordinates [32].

The present study focuses on Najafgarh Jheel, an urban wetland with ornithological significance, and its deterioration due to urban anthropogenic factors. The wetland has been threatened with its management due to its geographic location between two states. The wetland has recently been demarcated as a waterbody after an order from the National Green Tribunal (NGT). The present study will discuss the historical events of Najafgarh Jheel and the complications surrounding its conservation. Further, the study would quantify the data-based potential international significance of the jheel and its conservation importance.

Materials and Methods

Study Area

Najafgarh Jheel is a trans-boundary lake located in the southwest district of Delhi and Gurugram district of Haryana (28° 30' 21.48" latitude and 76° 56' 27.5" longitude), as represented on the map (Fig. 1). The Jheel is a fluvial freshwater urban lake in the Najafgarh Drain. The drain was a natural channel called the Sahibi River and functioned as a stormwater drain for neighbouring areas of Delhi and Haryana [33].

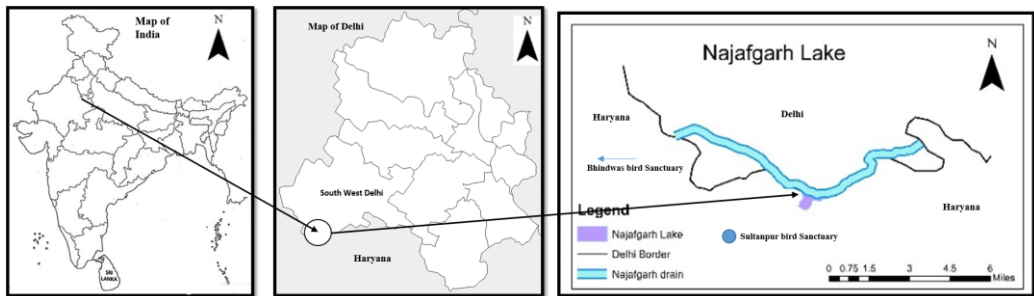


Fig. 1. Geographic location of Najafgarh Jheel as a transboundary lake and its vicinity of Sultanpur and Bhindwas Bird Sanctuary

Methods

The primary data collection was for the bird survey and population from January 2017 to April 2018 [34]. The secondary data collection for bird data was taken from the eBird Open Access platform for the Najafgarh Jheel Area checklist for the last 10 years. The dataset has multiple checklists submitted by different contributors that had 288 observed species and 496 complete checklists as of April 2022 [35]. The eBird data was analysed for bird population densities specific to records of peak numbers above 500 individuals for different species, along with their contributor, day, month, and year. The data was also analysed for a survey of endangered, near-threatened, and vulnerable species of waterfowl, along with their peak counts and dates they were last observed in the Jheel area. The contributors have been listed in the results, but the data has been retrieved from the main checklist that has been duly cited by the authors. Further, secondary data was collated from publications, state and central government websites, news articles, and state reports. The Environmental Action Plan, jointly developed by the states of Delhi and Haryana, has been considered the baseline data in case of discrepancies. The data collected was streamlined and focused on its relevance to the criteria (Sections A and B) given under the Ramsar Convention for designating a Ramsar site [36] and the criteria under the IBA programme [37].

Results and discussion

The Najafgarh Jheel's status as a water body was in jeopardy, and therefore no environment or conservation plans were developed until 2022. The detailed timeline of the Najafgarh Jheel is therefore important to understand its impact on biodiversity conservation.

The genesis of this study and the importance of its waterbird habitat and wetland protection requirements can be traced back to historical maps. The first map titled "Environs of Delhi" in 1807 retrieved from the National Archives of India depicts the presence of Najafagrah Jheel [38]. The map portrays the beginning of the 19th century and illustrates the environs of Delhi, in which the expanse of the Najafgarh Jheel was 220sq.km. [39] and covered the present-day areas of Nangloi Saiyed and Chaukhandi in Vishnu Garden in Delhi. The next map of around the year 1857, from the Delhi State Archives, titled "Western Jumna Canal", elaborated on the Shewing Irrigation Channels and Drainage Works completed and proposed. In this map, particularly a vast expanse of Najafgarh Jheel can be observed and has been demarcated as a predominant source of water [38]. The spread can be quantified by observing that the Jheel started in present-day Madipur and fell into present-day Jhuljhuli Village in Delhi. The next map that depicted the Najafgarh Jheel was retrieved from the National Archives of India, titled "Delhi Province," in the year 1915 [38]. This map depicts Najafgarh Jheel swampland instead of a physical lake. The area comprising the swampland symbol can be observed from Chhawla in the east, Dhansa in the west, Raota in the south, and Mundela Khurd in the north, respectively, in the present-day South-West district of Delhi. These maps show the existence and importance of the Jheel in historical context; however, the conservation of the Najafgarh Jheel was in jeopardy until the National Green Tribunal's decision in 2019.

The Najafgarh Jheel is linked to the now-known Najafgarh drain. The drain has its roots in the Arawali Hills of Rajasthan and Haryana, in the Alwar-Rewari area. Before joining the Yamuna in the north, it passes through NCT on the southwestern side. The drain used to be a natural waterway known as the 'Sahibi River', which aided principally as a storm water drainage conduit for the neighbouring states of Haryana and Delhi [33]. The Moti Ram Committee, 1965, suggested widening Najafgarh Drain after the impact of floods in Delhi during the 1964 floods [40]. The widening of Najafgarh Drain led to the draining of Najafgarh Jheel. Further, the jheel was impacted by supplementary drain construction in 1977 after the suggestions of the Tripathi Committee [41] and as stated in the Master Drainage Plan, Delhi, 1976.

The Indian National Trust for Art and Cultural Heritage (INTACH) submitted a plea in 2014 to the National Green Tribunal (NGT), India, against the governments of Delhi and Haryana for expecting the official designation of Najafgarh Jheel as a waterbody [41]. Initially, the state governments of Gurugram claimed that there was no natural lake in Najafgarh and that it was privately owned land. However, it was advised that the governments may look into previous records, as the 1983 gazette notification demarcated the area as a lake. In 2015, the Haryana Government agreed to demarcate the Najafgarh area from low-lying to water body status in the land use status [42]. The NGT in 2019 again directed the states of Delhi and Haryana to declare Najafagrah Jheel a waterbody under the Constitution of India, after INTACH claimed no action on the same post two years after the directions from the NGT. INTACH further expressed its concerns about serious encroachment and provided evidence to the NGT. Consequently, builders were penalised [43]. In 2020, the Department of Town and Country Planning (DTCP) ordered not to provide any further approvals to developers or individuals for the construction of structures near the Najafgarh Jheel [44]. The NGT had directed the Delhi and Haryana governments to notify and protect the Najafgarh jheel and together develop a consolidated "environment management plan (EMP)" draft in the year 2021 [45]. The Central Pollution Control Board (CPCB) found a gap in analysis and water quality measurements for Najafgarh Lake. The report suggested a comprehensive inquiry into drains that contribute to pollution and further establishing the point sources. The report, however, did not include

numerous physicochemical, microbiological, and other relevant monitoring parameters in contemporary and historic data. CPCB also recommended a long-term monitoring plan for Najafgarh Jheel and clarity on implementation duties that would be listed in the plan [46]. In the year 2021, Delhi-Najafgarh NCR's Jheel, which is the second-largest water body in the area, was chosen by the government to classify it as a trans-boundary wetland for its restoration, conservation, and regeneration [47]. The NGT recently, in March 2022, directed both the state governments to implement the EMP, and the Delhi government has initiated the process by listing action points for nine departments with timelines [48].

Ecological and biological Significance of the Najafgarh Jheel

The Najafgarh Jheel provides significant stormwater management for West Delhi and the Gurgaon municipality. The jheel is a key source of replenishing groundwater in municipalities, as stated by the Expert Appraisal Committee (EAC) of the MoEF in its 108th meeting in January 2012 [49]. The Jheel area provides natural infrastructure used as carbon sinks, flood buffers, wastewater treatment, and biodiversity hotspots [50]. The Najafgarh drain patch, near the Jheel, was already proposed for a bird sanctuary. Recently, the forest department indicated a possible bird sanctuary with an expanse of 50 acres of land around the lake. The prospective sanctuary is essential for wetland preservation and the conservation of its biodiversity and environmental value [50]. The Jheel has observed migratory, residential, and breeding grounds for avifauna and their linkages with regional environmental stressors [34].

Najafgarh Jheel a prospective site of International Importance

Hydrological connections: The map depicting "Main Locations, Drainage Lines, and Pertinent Hydraulic Structures" by INTACH reveals that the Najafgarh Jheel with Bhindwas Bird Sanctuary (outfall drain number 8) and Basai Wetlands (Badshapur Drain) are interconnected [39]. The Sahibi Nadi interjects Drain 8 while it flows from Bhindwas Bird Sanctuary to Najafgarh Jheel.

Bird Census: The Asian Waterbird Census (AWC) conducts the bird census, a citizen-science-based event, on January 1–16 every year. The census has also been conducted for Najafgarh Jheel (Fig. 2), and it can be observed that the population of the birds varies drastically. The population census of 2021 depicts Najafgarh Jheel's ecological carrying capacity of 20,000 plus waterbirds (Fig. 3), under criteria 5 of Ramsar site selection.

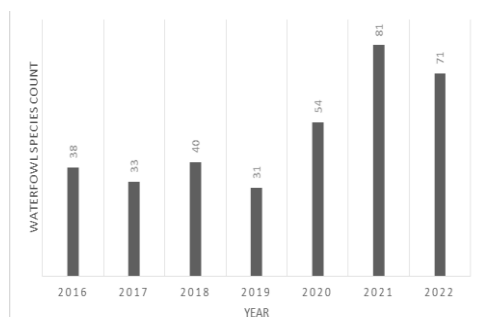


Fig. 2. The Asian Waterbird Census (AWC) depicting the Waterfowl Species Count for Najafgarh Jheel from 2016-2022 [51-54]

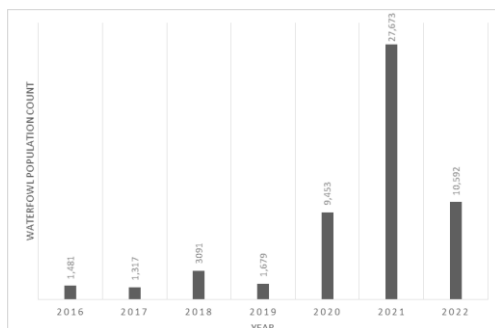


Fig. 3. The Asian Waterbird Census (AWC) depicting the Waterfowl Population Count for Najafgarh Jheel from 2016-2022 [51-54]

The bird data retrieved from the eBird Platform [50] to understand the conglomeration of birds in large numbers through different years is listed in Table 1. It has been observed that Najafgarh Jheel supports a Greylag Goose non-breeding population above the 1% threshold value according to Wetland International, which is 250 individuals as of 2012 in south Asia. Similarly, the Bar-Headed Goose and Indian Cormorant recorded populations of more than the 1% threshold of 560 and 300 individuals, respectively, as per 2012 in South and Southeast Asia.

The thresholds were used in the Ramsar factsheet for Bhindwas (Site No. 2459) and Sultanpur (Site No. 2457) bird sanctuaries in Haryana, which have been designated as Ramsar sites in May 2021. The population estimates of eBird data depict Najafgarh Jheel having more than 1% threshold populations of graylag goose, bar-headed goose, and Indian cormorant under criteria 6 of Ramsar site selection and A4 of IBA guidelines in relation to congregations.

Table 1. List of documented Avifauna with population densities above 500 individuals on the eBird Platform [34]

Scientific Name	Common Name	Status	Highest Count recorded Individual count	Date	Observer
<i>Anser anser</i>	Graylag goose	M	800	11-02-2020	Vivek Menon
<i>Anser indicus</i>	Bar Headed goose	M	2000	11-02-2020	Vivek Menon
<i>Anas acuta</i>	Northern Pintail	M	1000	11-02-2020	Vivek Menon
<i>Fulica atra</i>	Eurasian Coot	M	2000	05-01-2020	Pankaj Gupta
<i>Milvus migrans</i>	Black Kite	R	700	05-01-2020	Pankaj Gupta
<i>Phoenicopterus roseus</i>	Greater Flamingo	R	6212	Between 05-2019 to 02-2020	Amit Kumar & Sarita Rana 26 June 2021
<i>Gallinula chloropus</i>	Eurasian Moorhen	M	300	06-12-2019	Pankaj Gupta
<i>Himantopus himantopus</i>	Black-winged Stilt	R	500	06-12-2019	Pankaj Gupta
<i>Anas crecca</i>	Eurasian Teal	M	1000	15-12-2018	Pankaj Gupta
<i>Phalacrocorax fuscicollis</i>	Indian Cormorant	R	1000	22-06-2018	Punit Mehta
<i>Calidris pugnax</i>	Ruff	R	500	26-03-2017	Chinmoy Banerjee
<i>Porphyrio poliocephalus</i>	Gray-headed Swamphen	R	500	10-11-2015	Ramit Singal
<i>Phalacrocorax fuscicollis</i>	Indian Cormorants	R	1000	22-07-2022	Punit Mehta

Rare and threatened species and/or communities: The data from eBird showed that Najafgarh Jheel hosts eleven species of near threatened, seven species of vulnerable, and two species of endangered waterfowl populations, represented in Table 2. The Najafgarh Jheel, for vulnerable and endangered data, has nine species under Ramsar Criteria 2 [30].

Migratory Species and Nesting habitat: The species migration of Greylag Goose, Bar-headed Goose, Greater Spotted Eagle, Imperial Eagle, Common Pochard, and Ferruginous Duck are migratory birds of international importance under the Central Asian Flyway (CAF). The important migrations under the CAF of the mentioned species would relate to Ramsar Criteria 4. The wetland is also landbird habitat for the Whryneck, which migrates from Eurasia [50].

Resident Birds: Najafgarh Jheel has developed into a significant heronry and rookery. Furthermore, the primary field visit observed a rookery of nesting sites for Black-Headed Ibis, Cormorants, Egrets, and Darters (Fig. 4). The nesting populations of heronry and rookery could be considered for IBA A2 criteria for restricted range species. The breeding species are considered essential parts of the lifecycle and therefore would relate to Ramsar criteria 4 [31]. The Oriental Darter and Painted Stork are native to the Indian subcontinent. These species have a restricted assemblage region; hence, Najafgarh Jheel would fall under the A3 criteria of the IBA guidelines [30].

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Table 2. List of Endangered, Near threatened, and Vulnerable Species found at Najafgarh Jheel [34]

Scientific Name	Common Name	Status	Highest Individual Count	Recorded Date	Observer	Last Observed
<i>Limosa limosa</i>	Black-tailed Godwit	NT	200	23-10-2020	Vinod Gupta	Punit Mehta 20-03-2022
<i>Aquila heliaca</i>	Imperial Eagle	VU, CITIES and CMS Appendix 1	2	29-01-2022	Himanshu Sharma	Himanshu Sharma 18-02-2022
<i>Aythya farina</i>	Common Pochard	VU	48	10-01-2022	Himanshu Sharma	Himanshu Sharma 10-01-2022
<i>Sterna aurantia</i>	River Tern	VU	26	14-12-2021	Himanshu Sharma	Punit Mehta 20-03-2022
<i>Psittacula eupatria</i>	Alexandrine Parakeet	NT	8	28-11-2021	Akash Gulalia	Himanshu Sharma 01-04-2022
<i>Falco jugger</i>	Laggar Falcon	NT	1	25-10-2020	Pankaj Gupta	Pankaj Gupta 25-10-2020
<i>Clanga clanga</i>	Greater Spotted Eagle	VU	4	01-03-2020	Akash Gulalia	Himanshu Sharma 29-01-2022
<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork	NT	6	23-06-2019	Gopal Goel	Himanshu Sharma 06-02-2022
<i>Falco chicquera</i>	Red-necked falcon	NT	3	26-05-2019	Punit Mehta	Arvind Yadav 26-09-2021
<i>Clanga hastate</i>	Indian Spotted Eagle	VU	4	02-03-2019	Balbir Arora	Himanshu Sharma 18-02-2022
<i>Vanellus duvaucelii</i>	River Lapwing	NT	2	26-01-2019	Sohail Madan	Sohail Madan 26-01-2019
<i>Threskiornis melanocephalus</i>	Black-headed Ibis	NT	100	22-06-2018	Punit Mehta	Himanshu Sharma 01-04-2022
<i>Neophron percnopterus</i>	Egyptian Vulture	EN	2	08-06-2018	Surya Prakash	Sachin Sharma 26-03-2022
<i>Ciconia episcopus</i>	Woolly-necked Stork	NT	30	18-02-2018	Akash Gulalia	Kavi Nanda 04-04-2022
<i>Mycteria leucocephala</i>	Painted Stork	NT	120	26-06-2017	Pankaj Gupta	Kavi Nanda 04-04-2022
<i>Aquila nipalensis</i>	Steppe Eagle	EN	4	14-02-2017	Chinmoy Banerjee	Padmanav Kundu 27-02-2022
<i>Schoenicola striatus</i>	Bristled Grassbird	VU	1	28-08-2016	Nitin Kumar	Nitin Kumar 28-08-2016
<i>Anhinga melanogaster</i>	Oriental Darter	NT	25	07-08-2016	Kanwar B Singh	Punit Mehta 20-03-2022
<i>Antigone antigone</i>	Sarus Crane	VU	10	20-12-2015	Puja Sharma	Kavi Nanda 04-04-2022
<i>Aythya nyroca</i>	Ferruginous Duck	NT, CMS Appendix 1	15	27-02-2016	Abhishek Gulshan	Himanshu Sharma 10-01-2022

M: Migratory; R: Resident; VU: Vulnerable; NT: Near-threatned; EN: Endangered; CMS: Conservation of Migratory Species; CITIES: Convention International Trade in Endangered Species



Fig. 4. Najafgarh Jheel, primary field observation for site as heronry; rookery

Threats: The primary field data indicates illegal fishing during 2017 and 2018 (Fig. 5). The draft EMP lists the discharge of untreated wastewater, illegal waste dumping, and invasive species as key threats to wetland processes [50, 51]. Therefore, bird abundance and fluctuations observed are due to anthropogenic changes in the Najafgarh water quality, habitat degradation, climate change, and the availability of food for the birds.



Fig. 5. Anthropogenic Threats to Najafgarh Jheel observed during field visits: extensive illegal fishing and illegal waste dumping

Information absence: At present, the Najafgarh wetland does not have extensive citizen science or research-based data for branches of ichthyology, herpetology, or entomology. The research gaps for the Ichthyology studies, which are linked with Criteria 7 and 8, were not analysed in the present study. The data collection could further enhance the conservation significance of the area under the Ramsar Convention.

Conclusions

Wetlands are dynamic and complex habitats and cannot be considered isolated systems. The wetlands have biotic and abiotic connections and require sustainable utilisation of their ecosystem services [55]. The Najafgarh Wetland has hydrological and abiotic connections with the Bhindwas Bird Sanctuary, Haryana, which is a Ramsar site. These connections could determine the similarity in characteristics of the wetlands [56–58] and the movement of biota in terms of biotic connections [31]. The present study also demonstrates that Najafgarh wetland could be termed a satellite wetland of Bhindwas Bird Sanctuary. The study represents

ecosystem services provided by the wetland, such as supporting services for biodiversity and the possibility of it being developed into an eco-tourism area [59]. The Najafgarh Jheel has a geographic location on the path of the Central Asian Flyway, and degradation of habitats used as stopovers and breeding grounds has been a threat to the conservation of the waterbirds. The Najafgarh Jheel fulfils Criteria 2, 4, and 5 of Ramsar and has the carrying capacity to fulfil Criteria 5. The draft EMP of the state government does mention biodiversity conservation and monitoring under wetland rules but does not discourse on providing Najafgarh Jheel as a protected area status in the short term or long term [54]. The EMP for Najafgarh Jheel would just be an initiation towards a long-term commitment to manage and protect it. The responsibilities of building, preserving, restoring, and revitalising Delhi and Haryana lie with different institutional stakeholders. The conservation status of Jheel as a protected area would be required for biodiversity conservation as it is a potential habitat for waterfowl of national and international importance. Recently, Najafgarh Jheel was notified as a wetland under the Wetlands (Conservation and Management) Rules, 2017. The National Capital Territory of Delhi and Haryana governments should take a leadership role and notify Najafgarh Jheel as a protected bird sanctuary to conserve its complete ecological health. This step would further enhance India's obligations under the Migratory Species Convention of the United Nations. The protected area management authority would aid in extensive data collection to list the Najafgarh Jheel as an IBA. Lastly, long-term regular wetland wildlife monitoring, research, and conservation activities would lead to Najafgarh wetland being demarcated as a Ramsar wetland. The key takeaway from the study is to elicit systems thinking approaches and discussions among wetland managers, decisive institutions, and other stakeholders, therefore laying the groundwork for concrete initiatives to improve water management and biodiversity conservation.

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