



## The Dying Wetlands of Delhi: An Overview on the Threats and Conservation Strategies of Wetlands

Kalpita Sonowal<sup>1</sup>, Pravita Kumar<sup>2</sup>, Neetu Dwivedi<sup>1</sup>, Pramod kumar<sup>2</sup>, Rohit Mondal<sup>3</sup>

<sup>1</sup>Department of Environmental Studies, Sri Aurobindo College, University of Delhi, INDIA

<sup>2</sup>Department of Chemistry, Sri Aurobindo College, University of Delhi, INDIA

<sup>3</sup>Sri Aurobindo College, University of Delhi, INDIA

Received: 02 June 2019; Revised: 27 July 2019; Accepted: 24 Aug 2019

### ABSTRACT

India is endowed with an area of 4.3% of its total geographical area as wetlands, out of which Delhi share accounts for only 0.02% (2771 sq. km). Though wetlands comprise of only 4% of the total earth's surface, these are the most productive ecosystems and provide a wide range of ecological services like recharging of ground water, food, raw materials, habitat for wildlife, recreational values, etc. But these fragile ecosystems are under tremendous stress due to different anthropogenic activities like developmental activities, unplanned urbanization, pollution and growth of population, particularly in metropolitan cities like Delhi. As a consequence, there has been a decline in the hydrological, economic and ecological functions provided by the wetlands. This paper concentrates on the important wetlands of Delhi and gives an account on its importance and the continuous threats they are exposed to. It also discusses the management and restoration techniques that can be deployed to retrieve these dying entities.

**Key words:** Wetlands; fragile ecosystem; ecological services; threats; management and restoration

### 1) INTRODUCTION

Wetlands are defined as the transitional ecosystems between the terrestrial and aquatic ecosystems. The freshwater wetland communities occur in shallow areas of freshwater bodies or such areas which are inundated by water for at least some part of the year. The soil of such ecosystems is saturated with water continually. As they lie at the interface between the land and open waters they include a wide spectrum of habitats, subjected to water level changes of large magnitude and frequency that are not seen in terrestrial or true aquatic ecosystems [1]. Though occupying only about 4% of the area of the world [2], wetlands contain 10-14% of the carbon storage [3] and are valuable habitats for a variety of breeding, wintering and migratory species of invertebrates, fish and wildlife [4]. In addition to these, wetlands retain water during dry periods, mitigate flood, recharge ground water and trap the suspended solids of the runoff water.

### 2) AIMS AND OBJECTIVE

The present study is aimed at discussing some important wetlands of Delhi, the values of wetlands and the threats they are exposed to. This paper also focuses on the management and restoration techniques that can be deployed to retrieve the degraded wetlands.

#### Importance of wetlands

Wetlands provide many ecological services and commodities to the human society by its numerous

functions such as recharging ground water, attenuating floods, purifying water, recycling nutrients and also providing drinking water, fish, fodder, fuel etc. Wetlands are among the most productive ecosystems of the world. The economic benefits provided by the wetlands are in the form of water supply, recreation, tourism, biodiversity, food etc. But ironically, preservation of wetland ecosystem has received very little attention till recently [5].

Bolund & Hunhammar [6] in a study of Stockholm, Sweden, analysed the ecosystem services generated by ecosystems within the urban areas. Wetlands perform all the ecosystem services including air filtration, microclimate regulation, noise reduction, rainwater drainage, sewage treatment and recreational and cultural values [7]. The Millennium Ecosystem Assessment estimates conservatively that wetlands cover seven percent of the earth's surface and deliver 45% of the world's natural productivity and ecosystem services.

India with its annual rainfall of over 130 cm, varied topography and climatic regimes support and sustain diverse wetland habitats [8]. It is estimated that, India is about 757.06 thousand wetlands with a total wetland area of 15.3 mha, which accounting for nearly 4.75% of the total geographical area of the country [9] (fig.1A). According to the National Wetland Inventory and Assessment (NWIA),

\* Corresponding Author: **Dr. Neetu Dwivedi**  
Email address: [dwivedi.neetu@gmail.com](mailto:dwivedi.neetu@gmail.com)

has identified 98 wetlands and 301 smaller wetlands (less than 2.25 ha) in Delhi. The capital is endowed with only 0.93% of land areas as wetlands which accounts to a total area of 2771 ha [10]. Delhi is divided into nine districts. They are North, Central, East, West, South, New Delhi, North-East, North-West and South-East (fig.1B).

### Wetland types found in Delhi

Department of Environment, NCT Delhi has categorised the wetlands into following types:

- **Village pond or johar:** The village ponds are artificially created water bodies having very small, localized catchments for gathering rainwater. These are in a neglected state. Some of the ponds are either transformed into land filled urban area or are used to discharge the local waste.
- **Lakes:** Amongst the lakes the most prominent are Bhalaswana Lake, Sanjay Lake in the East Delhi, Hauz Khas, Hauz Shamshi, Old Fort Lake. Najafgarh Jheel which lies on the Haryana border used to be the largest lake in this area.
- **Marshes:** Jahangirpuri Marshes is presently the largest water body in Delhi, is now outside the floodplain embankments.
- **Stepwell and Baolis** are altogether different categories of water bodies which were created for drinking water purposes to draw the underground water. These are under Archeological Survey of India.

### Sanjay Lake

Sanjay Lake is an artificial lake developed by Delhi Development Authority (DDA) in Tilokpuri in East Delhi this is a rainwater fed lake. The lake is under threat because of increasing urbanization. After the development of Mayur Vihar Phase-II, DDA converted a lowland area

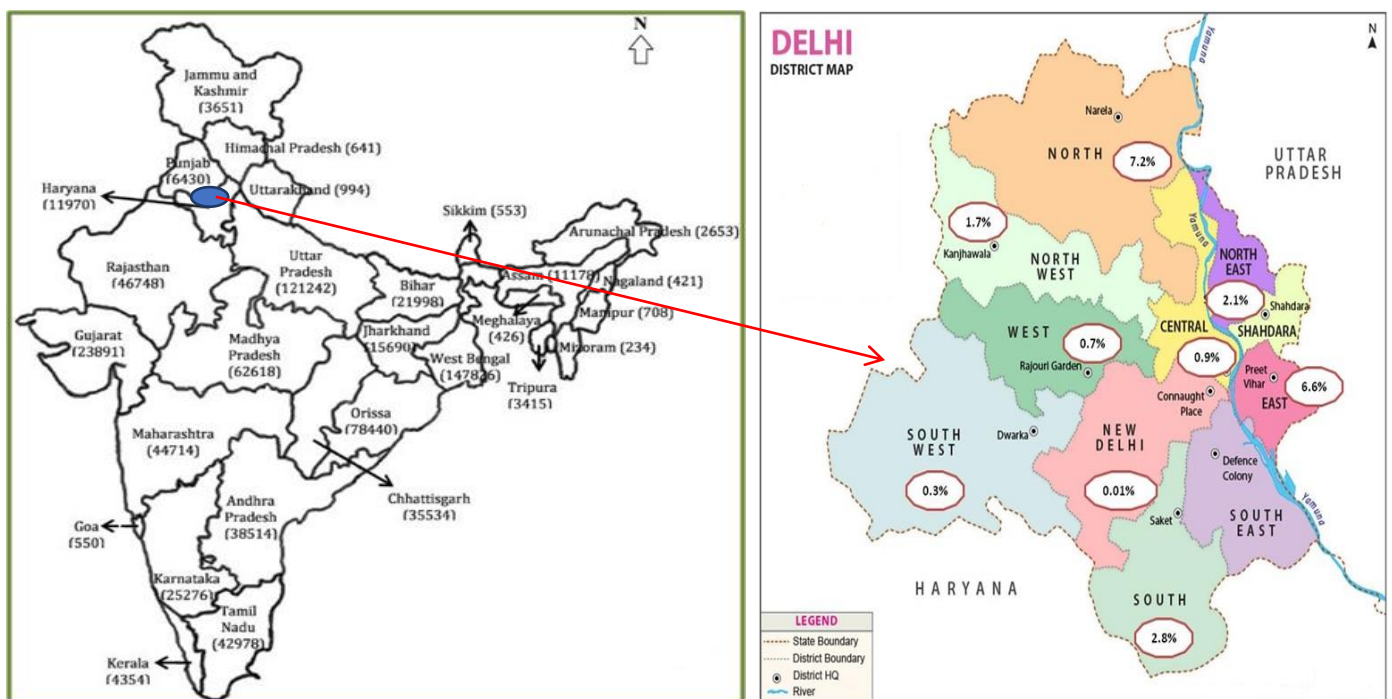
into Sanjay Jheel park. Sanjay Jheel was a huge rainwater fed natural lake. Sometimes, the water supply was augmented by back flow Yamuna. During floods it also received water from Hindon River. So, from ecological perspective Sanjay lake attenuate flood during the monsoon season. It is also a birders hub by being the host to almost 90 varieties of birds [11]. The migratory birds mostly come to the eastern part of the lake as the water is deeper and the area is free from human disturbance [12]. The lake was initially spread over 89 acres, however it got shrunk after different developmental activities including development of housing colonies by Delhi Development Authority (DDA). After that when National Highway 24 was built over the Yamuna river, its northern portion was lost and lake was reduced to the present 69 hectares. It is anticipated that if at this rate anthropogenic stressors increase at this rate, the lake would further shrink. The key factors that are elevating the loss are unauthorised construction, encroachment and sewage from nearby slums [13].

### Neela Hauz (Lake)

Neela Hauz Lake is the largest water body in South Delhi and is located in the Sanjay Van Ridge. As per the studies, it has shown that it was a part of a much larger watershed that drained this part of the Aravalis and through a system of drains (nallahs), reached Yamuna. Till some time back it served as the breeding ground for a specific variety of fish called Catfish (singhara) besides being a seasonal attraction for migratory birds [14].

The geological condition of Vasant Kunj does not allow percolation of rainwater. In such cases the role of a wetland is critical in a water scarce locality.

This water body was under threat from sewage water being drained into it. There was also dumping of sand



**Figure 1:** (A) Map showing State-wise number of wetlands in India. (B) Districts wise area of wetlands in Delhi.

Source (<https://www.sciencedirect.com/science/article/pii/S221458181400010X>, National Wetland Atlas, 2011).

during the Commonwealth Games which led to the degradation of the wetland ecosystem. However, because of repeated filing of Public Interest Litigation (PIL) the case was taken seriously. The area was handed over to DDA (Delhi Development Authority) under its Delhi Biodiversity Foundation wherein the scientists and engineers took the restoration process in their strides and within a span of two years the lake was desilted. Alongside an artificial wetland was created to treat almost a million litres of water naturally. The water before entering the lake (hauz) passes through a series of trough and gravel beds with aquatic plants growing on them. It is an example of reclamation of a dying wetland and how it can be converted to a heaven for the avian fauna along with other aquatic flora and fauna.

### 3) THREATS

The biodiversity of lake and pond ecosystem is currently threatened by a number of human disturbances, of which the most important include increased nutrient load, contamination, acidification and invasion of exotic species [15].

Healthy wetlands are essential in India for sustainable food production and portable water availability. The current loss rates in India can lead to serious

consequences where 74% of the human population is rural [16]. The wetland loss in India can be divided into two broad groups namely acute and chronic losses [8]. Landfilling of wet areas of soil constitutes acute loss whereas gradual elimination of forest cover with subsequent erosion and sedimentation of the wetlands termed as chronic loss. In a semi-arid region like Delhi where the ground water level is decreasing every year, loss of wetlands means loss in ecological services such as ground water recharging along with other productive values.

In a city like Delhi, the population is growing exuberantly without proper management of resources and planning. It is one of the factors leading to the encroachment and pollution of the wetlands. Moreover, wetlands thriving near to a highly developed area are highly degraded by the stressors associated with the development projects. In an urban area, the watershed area often carries high amounts of pollutants, runoffs with eroded soil, toxic chemicals and other petroleum products.

Following are some of the crucial stressors that cause the degradation of wetlands:

- Encroachments
- Population growth
- Urbanization



**Figure 2:** Lakes under poor condition **(A)** Neela Hauz, **(B)** Hauz Khas, **(C)** Sanjay lake, **(D)** Bhalsawa lake (Source: Google images)



- Fragmentation
- Loss of catchment area.
- Poor and erratic rainfall
- Siltation and Sludge deposition
- Landfillings and change in land use pattern
- Introduction of exotic species (e.g. Eichornia crassipes)
- Lack of awareness
- Climate Change

Bhalsawa lake in North Delhi is an oxbow lake apart of the flood plain area of the Yamuna River. Survival of the lake was at stake due to disconnection from the river to intervening embankments and land reclamation.

Hauz Khas is a manmade lake of historical times. However, because of urbanization and blockage by DDA, the lake was dry for several years. It had lost 80% of its catchment area since 1936 and the lakebed was a dry, barren pit. The Indian National Trust for Art and Cultural Heritage (INTACH) had taken up the initiatives to revive the lake. Water from a nearby Sewage Treatment Plant was diverted after bioremediation, passing through several check dams in Sanjay Van. The hauz was thus retrieved and converted into a recreational spot.

#### Conservation strategies

Wetlands conservation in India is indirectly influenced by an array of policy and legislative measures [17]. Following are the instrumental legislations:

**Legislations:** The Indian Fisheries Act-1857, The Indian Forest Act-1927, The Wildlife (Protection) Act -1972, Wildlife (Protection) Amendment Act-1991, Coastal Regulation Zone Notification-1991, National Conservation Strategy and Policy Statement on Environment and Development-1992, Biological Diversity Act, 2001.

**Policies:** National Policy and Macro level Action Strategy on Biodiversity-1999, National Conservation Strategy and Policy Statement on Environment and Development, 1992, National Forest Policy, 1988, National Biodiversity Action Plan, 2008.

The Government of India operationalised National Wetlands Conservation Programme (NWCP) in closed collaboration with the State Government during the year 1985/ 86. The main objective of the scheme was conservation and wise use of wetlands in the country so as to prevent their further degradation.

India is a signatory to the Ramsar Convention on Wetlands and the Convention of Biodiversity. In addition to the government regulations, initiatives should be made to assess, monitor and build up knowledge regarding the wetlands.

Strategies needed to be deployed in Delhi:

- **Survey and mapping:** Survey of the catchment areas, mapping can be done by the use of remote sensing. Use of satellite remote sensing data coupled with aerial photo-interpretation greatly aid in planning ground water exploration and help in locating the sources by identification of geomorphologic units. A comparative study is absent regarding the area of wetland that has been lost or encroached.
- **Inventorization:** regarding land use change/ human settlements, identification of point and diffused sources

of pollution, flora, fauna, weed profile, nutrient profile, physicochemical properties of the water etc.

- **Catchment Area Treatment:** Methods that can be used to secure the catchment areas are by vegetative contour building, check dams, desiltation, and plantations.
- **Restoration measures:** Restoration means reestablishment of pre-disturbed aquatic functions and the related physical, chemical and biological characteristics) with the objective of emulating natural and a self-regulating/perpetuating system that is integrated ecological landscape and the functions the wetland perform. The restoration programme should mandate all ecosystems, including habitat restoration, elimination of invasive species, and restoration of native species from the ecosystem perspective with holistic approach designed rather than isolated manipulation of individual elements. [18].
- **Water Management:** Hydraulic structures for flood mitigation, cleaning drainage, construction of sluice gate etc.
- **Biodiversity conservation:** The avian fauna biodiversity is a strong indicator to determine the health of a wetland. Conservation of sensitive species through in-situ and ex-situ methods.
- **Sustainable Resource Development:** Economic valuation of wetlands to determine and allocate resources on equitable basis. To strike a balance between development and ecological sustenance. A new approach towards coexistence of wetland and urban areas is the need of the hour.
- **Weed Control:** Removal by manual method, mechanical, biological and revenue generation from weeds.
- **Supplementary/ Alternative Livelihood:** Training for various activities like Animal husbandry, mushroom cultivation.
- **Environmental Education and Awareness.** Awareness amongst the public and general masses is very important to conserve wetlands. Nowadays people are paying attention to them as more Public Interest Litigations (PIL) are filed with respect to the wetlands. A few are in the National Green Tribunal regarding the waste to energy plant in Okhla Barrage, Neela Hauz etc. More awareness is needed to sensitize the case of degradation and encroachment of the wetlands.
- **Legislations:** In India we do not have any law that pertains to the wetland ecosystems. The State should make stringent laws on encroachment, landfilling and discharging of effluents into these ecosystems.
- **Research:** There is a need for more research on these unique ecosystems and innovation of techniques to control pollution and to restore the degraded wetlands.

**Climate change mitigation and adaptations:** Moreover, climate change will affect the hydrology of individual wetland ecosystems mostly through changes in precipitation and temperature regimes with great global variability. It will be critically important to determine specific expected future changes in climate by region and conduct adequate monitoring to ascertain how actual

conditions track with the specific climate change model for a region [19]. Many factors are associated with climate change like erratic precipitation, increase in maximum temperature and rate of evapo-transpiration.

#### 4) CONCLUSION

Though India is one of the mega diverse nations but little heed is paid towards the conservation of the wetlands. In Delhi, the root cause is overpopulation which triggers rampant developmental activities and industrialization. A more comprehensive study and inventory is required though initiatives are made by Ministry of Environment Forest and Climate Change from time to time. However, information about the wetlands from Delhi's perspective is inadequate. In order to implement proper conservation strategies by the policy makers a clear understanding of the causes and total loss incurred by individual wetland is a must as the problems faced by individual wetlands are unique. More research is needed to be focused on these issues to come up with strong techniques to restore the degraded wetlands.

#### REFERENCES

- 1) Singh, J.S., Singh, S.P. and Gupta, S.R. 2006. Ecology, Environment and Resource Conservation. Anamaya Publishers, New Delhi. 688 pages. ISBN: 81- 88342-55-6.
- 1) Prigent, C., Mathews, E., Aries, F. and Rossow, W.B. 2001. Remote sensing of global wetland dynamics with multiple satellite datasets, Geophysical Research Letters, (28) 4631-4634.
- 2) Armentano, T.V. 1980. Drainage of organic soils as a factor in the world carbon cycle. Bioscience (30): 825-830.
- 3) Mitsch, W.J. and Gosselink, J.G. 2000. *Wetlands*. River research and Application John Wiley, New York ed. 3<sup>rd</sup>, pages 920, ISBN:047129232.
- 4) Ministry of Environment and Forests (MoEF), 2012. Annual Report 2011-2012. MoEF, Government of India, New Delhi.
- 5) Bolund, P. and Hunnammar, S. 1999. Ecosystem Services in Urban Areas, Ecological Economics, (29): 293-301.
- 6) Singh, R. and Bhatnager, M. 2012. Urban lakes and wetlands, opportunities and challenges in Indian cities- Case study of Delhi. Daniel Thevenot. 12<sup>th</sup> edition of the World Wide Workshop for Young Environmental Scientists. Urban waters:resource or risks? Arcueil, France.3
- 7) Prasad, S.N. Prasad, Ramachandra, T.V., Ahalya, N., Sengupta,T., Kumar Alok, Tiwari A.K., Vijayan, V.S., and Vijayan L. 2002. Conservation of wetlands of India-a review. International Society for Tropical Ecology, 43 (1); 173-186.
- 8) Nitin B., M. Dinesh Kumar., Anuradha Sharma and Pardha S. 2014. Status of wetlands in India: A review of extent, ecosystem benefits, threats and management strategies, Journal of Hydrology: Regional Studies. (2), 1-19.
- 9) National Wetland Atlas, Space Application Centre, Indian Space Research Organisation, Sponsored by Ministry of Environment and Forests, Government of India, March 2011, 81-83.
- 10) Pratik, K. 2016. Adventure Park spells bad news for birds here. *Deccan Herald*. DHNS.
- 11) Kunal, R. 2014. "Will migratory birds come to Sanjay lake next year"? Daily news & Analysis. Retrived 29 September 2016.
- 12) Anonymous, 2012. Hope this isn't the last ride together, *Hindustan Times*.
- 13) Baishali, A. 2013. Neela Hauz cries for attention, *Deccan Herald*.
- 14) Bronmark, C., and Hansson, L. 2002. Environmental Issues in Lakes and Ponds: Current State and Prespective-Environmental Conservation. (29): 290-306.
- 15) Memon, M.F., Savani, B.D., Bhadja, R.K., Miyani, D.A., and Gupta. A. 2018. Current scenario of wetlands ecosystem. International Journal of Biological Research (3): 1-4.
- 16) Paul, M. and Chanda, M. 2011. Strategy and scenario for wetland conservation in India. Chronicles Young Sci (2):79-82.
- 17) Kumari, R., Shukla, S. K., Parmar, K., Bordoloi, N., Kumar, A. and Saikia, P. 2020. Wetlands Conservation and Restoration for Ecosystem Services and Halt Biodiversity Loss: An Indian Perspective. Springer Nature Singapore Pte Ltd. A. K. Upadhyay et al. (eds.), Restoration of Wetland Ecosystem: A Trajectory Towards a Sustainable Environment, [https://doi.org/10.1007/978-981-13-7665-8\\_6](https://doi.org/10.1007/978-981-13-7665-8_6).
- 18) Sinha, C.P. 2011. Climate change and its impacts on the wetlands of North Bihar, India. Lakes Reserv.: Research Management. 16 (2), 109-111.
- 19) Gopal, B. 2015. Guidelines for rapid assessment of biodiversity and ecosystem services of wetlands. Asia Pacific Network for Global Change Research (APN-GCR), Kobe, Japan, and National Institute of Ecology, New Delhi, p 134.