



Landscape Considerations in Wetland Management Reviving Gharana Wetlands

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ABSTRACT: Wetlands are considered to have unique ecological features which provide numerous products and services to humanity. Ecosystem goods provided by the wetlands mainly include: water for irrigation; fisheries; non-timber forest products; water supply; and recreation. Ghar-ana wetland (meaning welcome home) is paradise of migratory birds. Gharana and its adjoining wetlands of Makwal, Kukdian, Abdullian and Pargwal every year receive about 10000 to 20000 migratory birds in winter. All these wetlands are located along the border with Pakistan. This study follows the example of Gharana Wetlands (Jammu and Kashmir), and how it is under threat and needs to be protected. Also this study aims to propose landscape recommendations for its conservation.

Keywords: Wetland, Gharana, Landscape, Ecology, Conservation.

I. INTRODUCTION

Wetlands are defined as lands transitional between terrestrial and aquatic eco-systems where the water table is usually at or near the surface or the land is covered by shallow water.

Wetlands constitute vital components of the regional hydrological cycle. They are highly productive, support exceptionally large biological diversity, and provide a wide range of ecosystem services such as food, fiber, waste assimilation, water purification, flood mitigation, erosion control, groundwater recharge, microclimate regulation, enhance the aesthetics of the landscape, and support many significant recreational, social and cultural activities, aside from being a part of our cultural heritage. It was acknowledged that most urban wetlands are seriously threatened by conversion to non-wetland purposes, encroachment of drainage through landfilling, pollution (discharge of domestic and industrial effluents, disposal of solid wastes), hydrological alterations (water withdrawal and inflow changes), and over-exploitation of their natural resources. This results in loss of biodiversity and disruption in goods and services provided by wetlands.

There are different types of wetlands:

- 1.Coastal Wetlands
- 2.Shallow lakes and ponds
- 3.Bogs
- 4.Marshes and Swamps
5. Estuaries

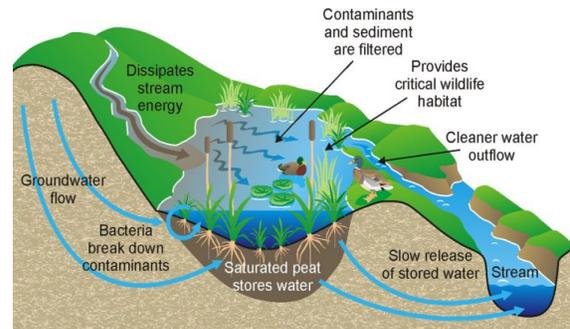


Fig. 1. Wetland[1].

II. NEED OF STUDY

There is a need to carry out a wide range of research into wetlands. This is principally because wetlands provide essential ecosystem functions and services, including regulation of water quality, sustainable control and mitigation of flooding, greenhouse gas reduction, essential habitats for plants and animals, and cultural and recreational facilities.

Wetland management generally involves activities that can be conducted with, in, and around wetlands, both natural and man-made, to protect, restore, manipulate, or provide for their functions and values

III. METHODOLOGY

Methodologies adopted to fulfill the aim and objectives are as follows:

1. Studying Wetlands and their importance

2. Assessment of the Importance of Gharana Wetlands as International Bird Area.
3. Analyze the various impacts on Gharana Wetlands with Ecological and Landscape perspectives
4. Study actions initiated for the conservation of Gharana Wetlands
- 5 Proposing mitigation measures by providing landscape recommendations for the conservation of Gharana Wetlands.

IV. LANDSCAPE ECOLOGY AND WETLANDS

Landscape Ecology approaches mean sustainable management and manipulation of ecosystems. This requires understanding the spatial scales at which wetland processes operate, including hydrological elements, surface as well as ground.

As Landscape Architects, our homework of understanding the wetlands is especially critical before intervening in sites with such fragile ecosystems because they are a resource from which sustainable development, design and construction benefit.

V. IMPORTANCE OF WETLANDS

Wetlands are considered to have unique ecological features which provide numerous products and services to humanity. Ecosystem goods provided by the wetlands mainly include: water for irrigation; fisheries; non-timber forest products; water supply; and recreation. Major services include: carbon sequestration, flood control, groundwater recharge, nutrient removal, toxics retention and biodiversity maintenance.

A. Biodiversity protection

1) Support a great diversity of species, many of which are unique and rare. Freshwater ecosystems cover only 1% of the Earth's surface but they hold more than 40% of the world's species and 12% of all animal species. Although they cover only 0.2% of the ocean floor, coral reefs may contain 25% of all marine species.

Associated product/service- Providing the transition between the aquatic and terrestrial environment and having features of the two, wetlands are considered amongst the most productive ecosystems in the world:

1. Fish form the primary source of protein for nearly 1 billion people.
2. Rice is the staple diet of 3 billion people – half of the world's population.
3. Other wetlands' products are used as construction material (reeds for thatching, timber for construction); as a source of fuel (plant residues may be formed into briquettes and used in homes, or they may be burnt directly); fibers for textile and paper-making; medicines

from bark, leaves and fruits; dyes and tannins used to treat leather, etc.

B. Water storage

Water is stored in the soil or retained in the surface waters of lakes, marshes, etc.

Associated product/service-

1. Flood control.
2. Erosion control – wetland vegetation stabilizes shorelines and protects from storms (by slowing down the wind speed, minimizing the effects of waves, water flow and runoff, and by trapping sediments). Wetlands reduce the need for expensive engineered structures.

C. Groundwater replenishment

Part of the water filters into the ground and recharges underground aquifers (groundwater reservoirs).

Associated product/service- Groundwater reservoirs store 97% of the world's unfrozen freshwater and provide drinking water to almost a third of the world's people:

1. In Asia alone more than a billion people rely on groundwater for drinking
2. In Europe 65% of public water supplies come from groundwater sources.

D. Sediment retention

By slowing down the force of water, encouraging the deposition of sediments carried in the water.

Associated product/service-

1. Sediment deposition prevention – deposition of sediments may block waterways further downstream.
2. High biological productivity – nutrients are often associated with sediments and can be deposited at the same time. Combined with the unique nature of the wetland ecosystem (a complex of zones with different characteristics), this makes wetlands one of the most productive ecosystems recorded.

E. Retention of nutrients and other substances

Wetland species (esp. plants) effectively remove nutrients (mainly nitrogen and phosphorous from agricultural sources but also from human wastes and industrial discharges).

Associated product/service-

1. High biological productivity – nutrients are often associated with sediments and can be deposited at the same time. This nutrient retention capacity, combined with the unique nature of the wetland ecosystem (a complex of zones with different characteristics) puts wetlands among the most productive ecosystems recorded.

2. Prevention of eutrophication further downstream – eutrophication is most often assigned with algal blooms, which lead to rapid oxygen depletion in the wetland and negatively affects other associated species.
3. Many wetland plants have the capacity to remove toxic substances that have come from agricultural, industrial or other activities. Wetlands prevent high concentrations of nutrients and toxic substances from reaching groundwater supplies or other water sources that may be used for drinking water, thus reducing the costs for its preliminary treatment.

F. Storehouses of Carbon

Associated product/service-Wetlands play at least two critical roles in mitigating the effects of climate change: one in the management of greenhouse gases (especially carbon dioxide, CO²) and the other in physically buffering climate change impacts:

1. Wetlands act as significant carbon sinks – the destruction of wetlands will release carbon dioxide, a greenhouse gas.
2. Wetlands will play a further role as the frontline defenders of coastal and inland areas as countries deal with the full effects of climate change: increasing frequency of storms, changing rainfall patterns, rising sea-levels and sea surface temperatures.

V. WETLAND ECOSYSTEM

Wetlands are shown to be three component ecosystems. The Hydrology of the landscape influences and changes the Physiochemical Environment, which in turn, along with Hydrology, determines the Biotic Communities that are found in the wetland.

A. Ecology of wetland ecosystem

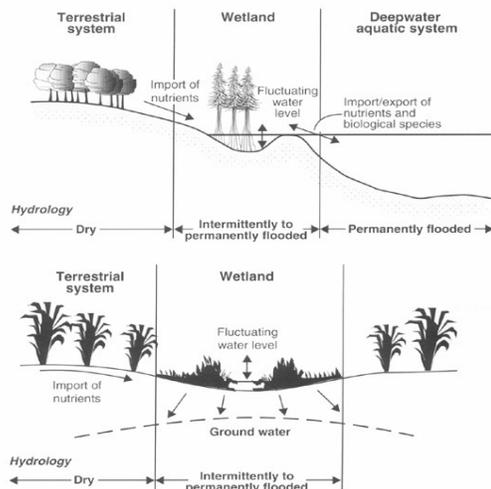


Fig. 2. Ecology of wetland[2].

Wetlands are often described as “kidneys of the landscape” [3]. Hydrologic conditions can directly modify or change chemical and physical properties such as nutrient availability, degree of substrate anoxia, soil salinity, sediment properties and pH. These modifications of the physiochemical environment, in turn, have a direct impact on the biotic response in the wetland [4].

IMPORTANT BIRD AREAS

An Important Bird and Biodiversity Area (IBA) is an area recognized as being globally important habitat for the conservation of birds populations. Currently there are about 10,000 IBAs worldwide. The program was developed and sites are identified by Birdlife International. These sites are small enough to be entirely conserved and differ in their character, habitat or ornithological importance from the surrounding habitat.

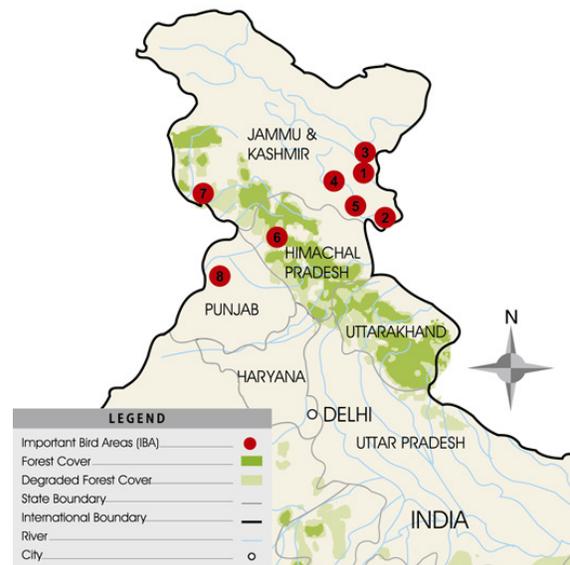


Fig. 3. Important Bird Areas.

Important Bird Areas in J&K

- 2) Chushul marshes
- 3) Hanle Plains (Hanle River marshes)
- 4) Pangong Tso
- 5) Tso Kar Basin
- 6) Tso Kar Basin
- 7) Pong Dam Lake Wildlife Sanctuary,
- 8) Gharana Wetland Reserve
- 9) Harike Lake Bird Sanctuary

VI. AREA OF STUDY

Gharana Wetland Reserve



Fig. 4. India's Location



Fig. 5. Area Location of R.S Pura In J&K.

About 40 kilometers from Jammu town, the winter capital of Jammu and Kashmir, lies Gharana village in R. S. Pura sector, along international border. A marsh area of three hundred acres in this village was notified as Wetland Reserve after a cabinet decision and government order in 1981.

Gharana Wetland (Reserve) is irregular in shape, covering approximately 1km² surface area and is situated in subtropical Jammu and Kashmir State, North western India (~) 10 miles east of the Indo-Pakistan International border. . It is surrounded by 'Gharana' village on its one half and by agricultural fields along its other side.

The wetland lies along the Palaearctic - Oriental Migratory Route of aquatic birds and serves as a feeding, roosting and wintering grounds for many bird species from Central Asia. The Wetland is declared as 'Important Bird Area' and is under J and K Wildlife Protection Act, 1978.

The notified wetland of Gharana, barring a small patch of marshy pond, and adjoining area, more or less comprises of agriculture fields. Paddy, a good quality basmati variety, is the major crop grown here.

However, by the time the birds arrive in Gharana during winter, the tender shoots of wheat are already in place. This, coupled with marshy patches and a variety of aquatic vegetation, probably qualifies the Gharana as the most sought after habitat of many bird species near Jammu town.



Fig. 6. Google Earth Image of Gharana Wetland.

About twenty thousand birds are estimated to throng this wetland and adjoining area during winter every year. This paradise for bird watchers supports as many as ninety species of birds including winter migrant birds. Common teal, Northern pintail, Northern shoveler, ruddy shelduck, gadwall, lesser whistling duck, purple swamp hen, little cormorant and ruff etc are some of the species conspicuously seen here during winter season. The major attractions include bar-headed geese, comb duck, mallard, Eurasian wigeon, common pochard, lesser whistling duck, spoon bill, black stork, woolly-necked stork and black necked stork. Some of the species like lesser whistling duck and purple swamp hen have been observed breeding in the area for last couple of years.



Fig. 7. Mashy Land At R.S Pura (Gharana).



Fig. 8. Migratory Birds at Gharana Wetland.

VII. VARIOUS WORKS HAVE BEEN CONDUCTED ON GHARANA WETLAND (RESERVE) TO DETERMINE

A. Physico-Chemical Parameters[5]

S.no	Parameter	Range
1.	Air Temperature	14 To 39 c
2.	Water Temperature	13 To 35 c
3.	The Range Of Depth	6.5 To 85 Cm
4.	Transparency	1.5 To 58.5 Cm
5.	Ph	6.6 To 9.6 It indicated an alkaline condition during most of the study period.
6.	Concentration Of Dissolved Oxygen	1.6 To 8.4 Mg/L
7.	Carbon Dioxide	0-40 Mg/L.
8.	Carbonates	Absent
9.	Calcium Concentration	16.04 To 64.16 Mg/L.
10.	Chloride	(518.96 Mg/L)
11.	Magnesium	(94.77 Mg/L)

The study revealed the occurrence of 21 species belonging to 5 orders and 6 families, out of which 6 species were resident, 14 species were migratory and 1 species was occasional visitor. Among migratory aquatic avifauna, 8 species were wintering and 6 species were transients.



Fig. 9. Fields Around Marshy Land In Gharana.

B. Seasonal Diversity

The highest number of species (18 species) was found in November and February. November had the highest (10673 individuals) and July had the lowest (44 individuals) waterbird population. During November, Bar-headed Goose *Anser indicus* contributed 92.01% (9820 individuals) to the total population of 10673 individuals. Family Anatidae accounts for 87.94% of the waterbird count.

The increase in the number of migratory species in winter is attributed to availability of space and food resources. Rice fields provide important water bird habitat from perspectives of food quality and quantity, as they provide natural food in form of moist soil plant seeds, and green forage.

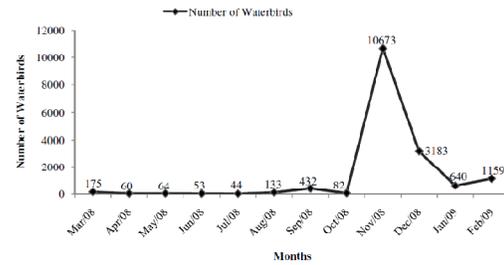


Fig. 10. Monthly Variation in Aquatic Avifauna of Gharana wetland [6].



Fig. 11. Habitat for Migratory Birds.

C. Avifaunal Diversity And Their Feeding Guilds[7]

Thus Gharana Wetland provides diverse food resources to the birds in form of plants and animals. Some birds find food in wetland soil and others in water column. Aquatic vegetation, abundance of benthic invertebrates, dipteran larvae, variety of insects and a wide stretch of paddy fields adjoining the wetland attributes to the different types of feeding guilds which were employed by various bird species. A wide stretch of agricultural fields skirting the wetland along with native trees provide additional food to birds in form of seeds, tree-fruits, bees, and animal feeds. So the birds like Red Wattle Lapwing, Indian Myna, White Wagtail, Grey Wagtail, Red Vented Bulbul showing multiple feeding guilds inhabit this area.

Availability of food in good quantity and quality constitutes one of the prime requisite of bird species in an area. Out of total 57 avian species reported, 16 species were carnivorous, 6 were grainivorous, 1 was frugivorous, 2 were omnivorous, 7 were insectivorous, 8 were herbivorous and 17 species used multiple feeding guilds [3].

VIII. THREATS TO GHARANA WETLAND

1. Military Activities : *Being located on the border, shelling by security people across the border is a constant problem.*

2. Invasive Species: The wetland is infested with *Water Hyacinth Eichhornia crassipes* and *Typha*. While the later may not be an issue as it is a native plant, the former is one of the most pernicious invasive weeds of India and has destroyed many wetlands.

This has caused profound changes in wetland structure, which could make those wetlands unsuitable for some species of birds.

3. Poaching: Poaching though hunting has been banned here even then it was prevalent here till the last few years.

4. Encroachment: Till now, no official demarcation exists between agriculture fields and the wetlands. This has progressively led to encroachments by the villagers. This agricultural expansion has negatively affected the wildlife especially the waterfowl.



Fig. 12. Land filling for increasing agriculture.

5. Other Threats and Issues

a) The basic facilities including road to the wetland is in most dilapidated condition. The road stretch from R S Pura to Gharana Wetland has hundreds of potholes and wretched stretches that give tourists quite a bumpy ride to remember.

b) There are no arrangements for bird watchers due to which the only guest house constructed by wild life department of the state government gets crowded with tourists that threatens birds and their very existence.



Fig. 13. Bird watching at Gharana.

c) Being adjacent to the village, various anthropogenic activities are carried out like cattle bathing, washing of vehicles, laundry, entry of domestic sewage and cattle waste, drawing of water by electric motor, hunting, fishing, expansion of agricultural fields towards wetland etc. . Regular interference of villagers keep the waterbirds away from the edge.

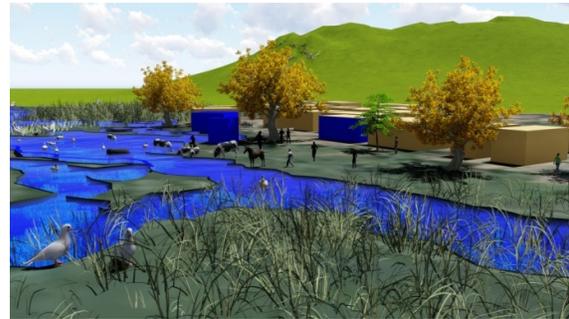


Fig. 14. Anthropogenic activities carried out at Gharana.

d) Due to the shallowness of the wetland they access their agricultural fields by passing through the wetland. It was further observed that such anthropogenic influences restricted the use by water birds. Very few water birds were recorded who came to the shore throughout the year for foraging and they prefer the centre of this wetland in order to avoid disturbances.

e) Direct approaches of people on foot were very disruptive to the water birds causing flight and reducing their foraging times (Burger and Gochfeld, 1993; Thomas et al., 2003; Marcum, 2005). Stolen (2003) and Blanc et al. (2006) also revealed negative impact of human disturbance on waterbirds by reducing their feeding times.

IX. PROPOSAL

A. Landscape Ecology Approach

Looking at a landscape ecological approach, there are several landscape scale features useful to have clarified. The ideal landscape texture is a coarse-grained matrix containing fine-grained areas providing for:

1. Large-patch ecological benefits
 2. Multi-habitat species including humans
 3. Maximum effective delivery of ecosystem services.
- And, of course, wetlands can be coarse grained, or fine.

1) Landscape change is land or water being transformed by several spatial processes overlapping in order, including

1. perforation,
2. fragmentation and attrition, which increase habitat loss and isolation, causing very different effects on spatial pattern and ecological processes.

2) Landscape design is best done by aggregating land uses, and maintaining small patches and corridors of "nature" throughout developed areas, as well as some human activity spatially scattered in the broader matrix. Ideally, all such design should incorporate wetlands.

Landscape ecology approaches mean more possible management manipulation of ecosystems.

In part understanding and recognition of the emergence of semi-stable and stable novel ecosystems (Hobbs *et al* 2006) and planning for a Global Garden vision (Bridgewater, 1997). All this means understanding the spatial scales at which wetland processes operate, including hydrological elements, surface as well as ground.

B. Landscape-Level Management

Since wildlife don't recognize property boundaries like humans do, it is important to consider the bigger picture of how a particular site or tract of land works with the surrounding landscape to provide regional habitat. No field or piece of land exists in a void. The animals and plants in and around the site are affected by and interact with the surrounding landscape. The landscape-level considerations discussed here should always be evaluated in creating and managing wetland habitat.

Linear patches of aquatic habitat are usually less desirable than unevenly shaped ones. Irregular edges often create varied habitat along the perimeters of wetlands, making niches in which different types of plants can establish. More diverse plant life can in turn attract and support a larger variety of wildlife. If you have an existing pond or marsh with symmetrical borders, you can take steps to vary the habitat. Creating peninsulas and coves, forming islands, and creating plant mosaics can increase the complexity of your wetland and its attractiveness to wildlife.

Two main management criteria need to be considered on Gharana wetland site:

1. Demarcation of wetland from the village.

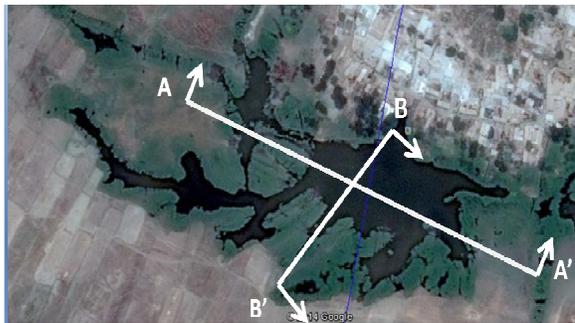


2. Creating buffer zone



- 1. WETLAND ZONE
- 2. BUFFER
- 3. RESIDENTIAL
- 4. WATER FILTER

Land profile



The wetland can grow parallel to the village



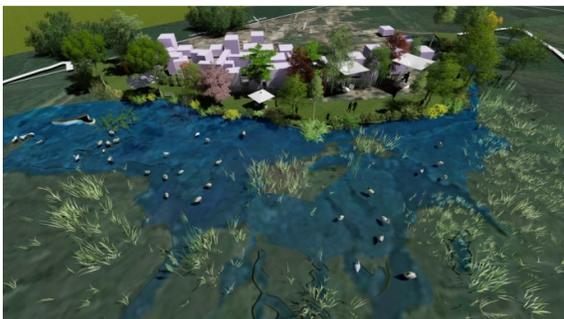
Section at A-A'



Section at B-B'

X. RESULTS





Ecological balance and harmony

XI. CONCLUSION

Public perceptions of wetlands have come a long way in the past few decades, yet wetlands are still being lost throughout the country. Habitat loss can directly impact birds using these areas by potentially influencing bird abundance and habitat use, reproduction, and survival.

A. Ecological Restoration As Mitigation

Worldwide, ecological restoration is a growing scientifically based discipline. More strictly defined, restoration is one level of rehabilitation of natural ecosystems. Rehabilitation may involve regeneration, restoration or reinstatement (often in combination) that represents progressively greater degrees of human intervention.

- **Regeneration** means the natural recovery of natural integrity following disturbance or degradation.
- **Restoration** means returning existing habitats to a known past state or to an approximation of the natural condition by repairing degradation, by removing introduced species or by reinstatement.
- **Reinstatement** means to introduce to a place one or more species or elements of habitat or geo diversity that are known to have existed there naturally at a previous time, but that can no longer be found at that place.

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