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FLOODPLAIN WETLAND (BEEL) FISHERIES IN INDIA



ECOLOGY AND CLASSIFICATION OF FLOOD PLAIN WETLANDS (BEELS) OF INDIA

INTRODUCTION

- **The floodplain wetlands are either permanent or temporary water bodies associated with rivers that constantly shift their beds especially in the potamon regimes.**
- The frequency with which river changes its course depends on a number of variables like flow velocity, sediment transportation rate, slope, channel pattern, water and sediment yield, amount and duration of precipitation over the catchment area, texture and lithology of soil, tectonic status.
- National Commission on Agriculture stated that the freshwater fishery resources, which have progressively gone into dereliction, comprise the floodplain wetlands.

- The floodplain wetlands usually represent the lentic component of floodplains viz., ox-bow lakes, sloughs, meander scroll depressions, residual channels and the back swamps and excludes the lotic component (the main river channels, the levee region and the flats).
- In addition, all the wetland tectonic depressions located in river basins are also included under floodplain wetlands. Thus, all the wetland formations located at the floodplains can be termed as flood plain wetlands.
- These are also called ox-bow lakes, locally known as **Beels** in **Assam, Arunachal Pradesh, Meghalaya and Tripura**, **Maun, Chaur and Dhar** in Bihar, **Pat** in Manipur, **Beel Charha** and **Baor** in Northern and Southeastern West Bengal and **Jheels / Tal** in Uttar Pradesh.

- Wetlands are among the **world's most productive environments**. They provide tremendous economic benefits to mankind through fishery production (over 2/3 of world's inland fish harvest is linked to the health of wetland areas), the maintenance of water tables for agriculture, water storage and flood control, shoreline stabilization, timber production, waste disposal, water purification and recreational opportunities.
- They provide critical habitats for birds (especially water fowl), mammals, reptile, amphibian, fish and invertebrate species, some of which are threatened with extinction.

- The wetlands associated with floodplains of rivers cover an estimated area of 0.2 million ha. They are a common feature of Indian landscape, especially along the Ganga and Brahmaputra river systems. There are 1,392 beels in Assam, of which 423 are registered with the Government and the remaining 960 are unregistered. Altogether derelict and semi-derelict wetlands are estimated to cover an area of 1,00,000 hectares.
- Referring to the flood plain wetlands of the country, Sugunan and Sinha observed **“Floodplain wetlands form an important fishery resource in Assam, West Bengal and Bihar, where thousands of poor fishermen are dependent on these water bodies for their livelihood”**

Geomorphology

- The floodplain wetlands are an integral component of the Ganga and the Brahmaputra basins.
- The Indo-Gangetic plains are situated between the southern peninsula i.e. oldest mass in the Indian sub-continent and the extra peninsular Himalayas in the north.
- The Himalayan mountains are comparatively of recent origin and are distributed by earth movement, as evident from rock being folded, faulted, over thrust and even carried over some distance as thrust sheets.

- The plains occupy the depression in the earth's crust between these two elevated regions. Here the sediments are of recent origin and largely consist of silt which can be easily eroded.
- The Indo-Gangetic alluvial tracts, especially in the northeast, are also geologically unstable and experience earthquakes of varying intensities from time to time. Two devastating earthquakes occurred in northeast during 1897 and 1950.

Origin of floodplain wetlands

- The lithology, geological structure, tectonic status, seasonal variation in river discharge and flow characteristics largely determine the formation of floodplain wetlands. The beels of country owe their origin either to the often changing course of river in the potamic stretches or tectonic adjustment.
- In the northern part of Bihar and West Bengal as also in Assam, the river emerging from the central and eastern Himalayas suddenly debouch into plains and ultimately flow down as the river Ganga, Brahmaputra and Barak. These river carry heavy loads of silt and detritus from the Himalayas and overflow during southwest monsoon season submerging huge tracts of land every year. These river change their course every often creating numerous floodplain lakes and braided channels, mainly in the form of oxbow lakes.

- In deltaic West Bengal, due to low gradient and high riverine discharge during monsoon season, rechannelisation of rivers occurs at the slightest obstruction to flow, resulting in creation of beels of varied types. In the northeast i.e. Assam, foothills of Arunachal Pradesh, Meghalaya, frequent earthquakes coupled with heavy rainfall and cutting action of river meanders have resulted in the formation of typical ox-bow lakes, lake like beels or true tectonic depressions.
- The pats of Manipur owe their origin mainly to the cutting action of stream meanders.

Physico-chemical features of soil and water

- Important physico-chemical features of soil is, bottom very rich with organic carbon, available nitrogen and phosphorus. Bottom soil of these lakes is enriched by organic matter, inorganic minerals through deposits of decaying weeds, incurring of river water and surface run-off, therefore all the aforesaid parameter change from year to year.
- Floodplains of Ganga system are more or less alkaline whereas the lakes of Brahmaputra basin are acidic to neutral in nature. Among the dissolved gases, the concentration of dissolved oxygen and free carbon dioxide always remains at optimum level. The total alkalinity and specific conductivity range of water is indicative of moderate to high production.

- The dissolved organic matter of water which determines the chemical oxygen demand (COD) is quite high. The high values may be attributed to constant loading of organic detritus and sedimentation due to death and decay of macrophytes.
- In contrast to rich nutrient status of soil phase, the nutrient status of water has low nitrate and phosphate. It appears thus both the major nutrients are locked either in soil phase or macrophytes. Judging from ecological yardstick, it is evident that nutrient status of soil and of water of these lakes is extremely high. The shallow nature of the basin, presence of euphotic zone and rich nutrient status are attributed to fish production.

Components of a typical flood plain

According to Leopold *et al.*, (1964), a typical floodplain will include the following

- i. **The river channel**
- ii. **Ox bow lakes** : cut off portion of meander bends of river.
- iii. **Point bars** : these are loci of deposition on the convex side of curves in the channel.
- iv. **Meander scrolls** : Depressions and rises on the convex sides of bends formed as channel migrates laterally down valley by the corrosion of the concave bend.
- v. **Sloughs** : area of dead water formed both in the meander scroll depression and along the valley walls as flood flow more directly down valley scouring adjacent to the valley walls.

- vi. **Natural levees** : Raised banks or crests above the floodplain surface adjacent to the channel, usually containing coarsest materials deposited as flood flow over the top of the channel banks. These are most frequently found at the concave bank and are submerged annually. They may be absent or imperceptible where most of silt load in transit is fine grained.
- vii. **Back swamp deposits** : over bank deposits of finer sediment deposited in slack water ponded between the natural levees and the wall or terrace riser. These are submerged for long period of the year.
- viii. **Sand splays** : deposits of flood debris usually coarse sand particles in the form of splays or scattered debris

Classification of floodplain wetlands

The floodplain wetlands include low lying water bodies of diverse origin, size, shape, depth, inundation pattern, ecological characteristics etc.

They can be classified as below

1. **Classification based on morphology**
2. **Classification based on water retentivity**
3. **Classification based on depth**
4. **Classification based on size**
5. **Classification based on riverine connection**
6. **Classification based on the extent of macrophyte infestation**

1. Classification based on morphology

- i. **Ox-bow lakes** : These are cut off portion of river meanders. The basins are relatively narrow, long, deep and have either bend or straight shapes. They derive the name from their shape, which is usually horse-shoe shaped, crescent shaped or serpentine. They receive water from the parent river through the old channel or neighbouring catchment areas.

- ii. **Lake like wet** : These are wide and shallow with irregular contours. They may be connected to the river through channels or receive water from it during floods. During the monsoon season, the entire neighbouring areas gets flooded turning the beels into vast sheet of water whereas during non-monsoon season the water spread area shrinks to the basin proper.

iii. True tectonic depressions : These are created by tectonic activities like earthquakes and usually resembles natural lakes with regular contours. Normally they are not connected to river through connecting channels but may receive water from latter during floods. Such tectonic wetlands are common in the northeastern region.

iv. Meteorite lake : These are created by the impact of full of a meteorite on earth. Such beels have regular, nearly oval shape and abnormally high banks on all sides, which, according to geologists, can be created when the left over portion of a large meteorite hits the earth. The morphometric features of the beels are similar to those of volcanic lakes, except for the fact that they are located in the plain and are very shallow.

2. Classification based on water retentivity

- i. **Seasonal *beels*** : These are shallow floodplain wetlands, which periodically get inundated by monsoon rains and floods but completely dry up during summer months.

- ii. **Perennial *beels*** : Deeper and permanent beels, which retain water round the year

3. Classification based on depth

- i. **Shallow beels** : having max. depth up to 5 meters
- ii. **Medium beels** : having max. water depth ranging from 5 – 10 m.
- iii. **Deep beels** : having max. depth of over 10 metres

4. Classification based on size

- i. **Small beels** : Effective area less than 100 hectares.
- ii. **Medium beels** : Effective area 100 – 500 hectares.
- iii. **Large beels** : Effective area more than 500 hectares

5. Classification based on riverine connection

- i. **Open beels** : These beels retain continuity with parent river either for the whole year or at least during the rainy season. Such beels have continuous exchange of water as well as fish fauna with parent river.

- ii. **Closed beels** : These beels are completely cut off from the nearby river and receive water mostly from their catchment area following monsoon rains or during high flood

6. Classification based on the extent of macrophyte infestation

- i. **Weed choked beels:** A *beel* can be considered a weed choked when more than 50% of the total water spread area is covered by aquatic macrophytes.

- ii. **Moderately weed infested beels :** A *beel* can be considered as moderately weed infested when less than 50% of total water spread area is covered by aquatic macrophytes