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Status of wetlands in Uttar Pradesh and their conservation, management and restoration strategies

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Abstract
Wetlands are unique type of ecosystems that arises when inundation by water produces soils dominated by aerobic and anaerobic processes. Wetlands are considered the most biologically diverse of all ecosystems, serving as home to a wide range of plants and animals life. India has about 757.06 thousand wetlands with a total wetland area 15.3 m ha, accounting for nearly 4.7% of the total geographical area of the country, and Uttar Pradesh is India s fourth largest by land area, and most populous state, located in the north central part of the country. It spreads over 243,290 square kilometers (93,935 sq mt). There are 47 Ramsar sites in India and U.P.is home to 10 Ramsar wetlands. These wetlands provide numerous ecological goods and services but are under tremendous stress due to unplanned urbanization, industrialization and agricultural intensification, manifested by shrinkage in their size and decline in the hydrological, economic and ecological functions they perform. There is no proper regulatory framework for conservation of wetlands in India. Rehabilitation of wetlands is required because these are the most productive habitats on the planets. Restoration of wetlands can be achieved successfully only when from early planning to post implementation monitoring and are offered here for use by a wide variety of people and organization, ranging from Federal, state tribal and local agencies to outdoor recreation or conservation groups, corporation, land owners and citizen s groups. Future research should focus on institutional factors influencing their condition. This paper aims to draw the attention of environmentalists, scienticists, policy makers and academicians for the stressors of wetlands of Uttar Pradesh and their management strategies.

Keywords: restoration strategies, wetlands, conservation

Introduction

Wetlands are kidneys of the environment. wetlands occur naturally on every continent wetlands are characterized as having a water table that stands at or near the land surface for a long enough period each year to support aquatic life. Wetlands are a community composed of hydric soil and hydrophytes. According to Mitsch and Gosse link wetlands exists at the interface between truly terrestrial ecosystems making them inherently different from each other, yet highly dependent on both. Wetlands include mangroves, peat lands and marshes, rivers and lakes, deltas, floodplains and flooded forests, paddy fields and coral reefs.

Wetlands are unique type of ecosystems that arises when inundation by water produces soils dominated by anaerobic and aerobic processes. Wetlands are most productive ecosystems on the earth (Ghermandi et al.2008) and serves human beings in a very effective manner (ten Brink et.al.2012) [13]. However, they are also ecologically sensitive and adaptive systems (Turner et.al.). Wetlands are delicate systems, making them susceptible to even subtitle levels of disturbances. Developed by the world wildlife fund and the University of Kassel in Germany, the global lakes and wetland database (GLWD) hosted on resource watch shows the location and type of 10 million square kilometres of wetlands, which cover about 7 percent of the earth's surface. Though they cover only around 7 % of the earth's land surface, 40% of all plant and animal species live or breed on wetlands. Global inland and coastal wetlands cover over 12.1km square, an area almost as large as Greenland, with 54% permanently inundated and 46% seasonal in an inundated. One of the first widely used wetland classifications system (devised by Cowardin *et al*, 1979) [1] categorized wetlands into marine (coastal wetlands), estuarine (including deltas, tidal marshes, and mangrove swamps), lacustarine (lakes), riverine (along rivers and streams), and palustarine ('marshy'- marshes, swamps and bogs) based on their hydrological, ecological and geological characteristics. However, Ramsar Convention on Wetlands, which is an international treaty signed in 1971 for national action and international cooperation for the conservation and wise use of wetlands and their resources, defines wetlands (article 1.1) as "areas of marsh, fen, peat land or water, whether natural or artificial, permanent or temporary, with which that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters".

However, many other wetlands which perform potentially valuable function are continued to be ignored in the policy process. As a result many freshwater wetlands ecosystem are threatened and many are already degraded

and lost due to urbanization, population growth, and increased economic activities (Central Pollution Control Board, 2009) [2].

There are presently 171 contracting parties to the convention, with 2,392 wetlands sites, totalling 253 million hectares, designated for inclusion in the ramsar list of wetlands of international importance. UP TO 2020,973 marine and coastal wetlands Ramsar sites covering 72,790,070 ha have been designated under convention. India has maximum wetlands in south Asia-7.7lakh-covering the country's 4.6%geographical areas. But we have lost maximum wetlands (71%) from 1970-2014.this is not just a biodiversity crisis but as a development crisis manifesting into increased water, food and climate insecurity. A draft report of the environment ministry reported by HT in December 2019 had listed 42 of the 100 top wetlands in the country in high risk category facing threat from encroachment and high human interference. There are 48 Ramsar sites in India, the wetlands listed under the Ramsar Convention. Among all the 48 sites, Uttar Pradesh has the highest number of Ramsar Sites, with 10 wetlands considered to be of international significance. The negative economic, social, and environmental consequences of declining water quality in wetlands are also an issue of concern in U.P. All activities carried out on the ground surface have direct or indirect impact on the ground water, whether associated with urban, industrial or agricultural activities. Large scale concentrated sources of pollution such as industrial discharges, landfills and subsurface injection of chemicals & hazardous wastes are richest sources of ground water pollution. Uttar Pradesh being one of the most dominant industrial and agricultural states of North India is most prone to ground water pollution resulting in deterioration of wetlands especially small water bodies. Encroachment of reservoir area for urban development, excessive diversion of water agriculture is yet another major problem (Verma, 2001). Lack of conformity among government policies in the areas of economies, environment, nature conservation, development planning is one reason for the deterioration of these water bodies (Turner *et al* 2000) [14]. lack of good governance and management are also major reasons (Kumar *et al* 2013) [5].

Two decade before, wetland conservation and their management was not the political agenda or it was almost non –existent. Lately the National Environmental Policy 2006 recognized the importance of wetlands in providing numerous ecological services. (MoEF, 2006) [9]. The policy for the first time accepted that there is no formal system of wetland regulation in the country except the ramsar convention and thus it had been realized that there is a need of legally enforceable regulatory mechanism for identified valuable wetlands to prevent their degradation and enhance their conservation (Dandekar *et al.*2011; MoEF,2006) [3, 9]. Uttar Pradesh is India's fifth largest state by land area, and the most populous state, located in the north central part of the country. It spread over a large area U.P. has the maximum number of Ramsar sites among the 49 in India.in Uttar Pradesh, most of the aquatic vegetation is found in rivers, lakes and riverine wetlands, National smart cities mission is an urban renewal developmental program by the Government of India with the goal to develop smart cities across the country, making them citizen friendly and sustainable. In U.P. alone 10 cities will be developed under this scheme, for this several developmental programmes have been implemented. The objective of this paper is to review the status of wetlands in Uttar Pradesh, their areal distribution, their ecological and economical importance, stressors of wetlands and to draw the attention of policy makers, administrators, scientists and environmentalists towards the sustainable development of wetlands so that we can conserve our natural heritage.

Objective: - Objectives of This Study Are To

- List wetlands of Uttar Pradesh
- Analyze economic and ecological significance of these wetlands
- Identify major stressors of wetlands of U.P.
- Draw the attention of policy makers and environmentalists for restoration and management of these wetlands.

Methodology

Exploratory surveys involving field visits and literature review were carried out to find out present status of wetlands of Uttar Pradesh. As U.P.is economically and ecologically very important state of India and has maximum number of wetlands (10) of the country but at the same time more susceptible for the degradation of wetlands due to population load and pollution load. Based on the quality assessment and socio-economic aspects investigation suitable management strategies were suggested.

Results and Discussion

According to wetland Atlas of India (map and statistics) Entire country including the islands territories has been considered for inventory and assessment of wetlands. Mapping was carried out on 1:50,000 scale. Area estimates of various wetlands categories for India have been carried out using GIS layers of wetland boundary, water-spread, aquatic vegetation and turbidity. Total 201503 wetlands have been mapped at 1:50,000 scale in the country. In addition 555557 wetlands (<2.25 ha) have also been identified. Total wetland area estimated is15.26Mha, which is around 4.63 percent of the geographic area of the country. Wetlands were categorized in to two major categories, 4 sub categories and 19 classes. Area under inland wetlands is 10.56 Mha and area under coastal wetlands is 4.14 Mha. Category –wise distribution of wetlands in the country is shown in table 1 and figure 1. Analysis of wetlands status in terms of open water shows that out of the total wetlands area the extent

of open water is 58.5%in post monsoon and 39.4%in pre-monsoon. There is a significant reduction in the extent of open water (about 32.5%) from post-monsoon to pre monsoon (8.60Mha to 5.80 Mha). It is reflected in all the inland wetland types.
The aquatic vegetation in India accounts for about 9 and 14 %of total wetlands area in post monsoon (1.32Mha) and pre-monsoon (2.06Mha) respectively.

Status of wetlands of Uttar Pradesh
According to the National Wetland Atlas that is based on satellite data, total 23890 wetlands have been mapped at 1:50000scale in the state. In addition, 97352 smaller wetlands (smaller than 2.25 ha) are also identified. Total wetland area estimated is 1242530 ha; this is around5.16 percent of the geographic area (table). Graphical distribution of wetland type is shown in figure.
The natural wetlands dominated the area with around 74 percent share. The major natural wetland types observed in the state are; river/stream, lake/pond, ox Bow Lake, riverine wetland and water logged areas. The rivers and stream which are perennial, contribute around 49 percentage of wetland area of the state. Reservoir/Barrage and waterlogged areas dominated the man made wetlands.
Aquatic vegetation is more during post monsoom season with 219289 ha during post –monsoon and 129228 ha during pre-monsoon season. The open water area of the wetlands decreased by around 28.0% in pre-monsoon compared to post monsoon season. This is due to change in water spread observed in two major types: river/stream (6%) and reservoir /barrage (37%). The turbidity of open water is in general moderate and low in both the seasons.

District wise wetland status of U.P
The state has seventy five districts. The geographic area of the districts varied from 1015 to 7680 sq.km. District-wise distribution of wetlands showed that there are many districts having wetland area more than 5 percent of their geographic area. Wetland area varied from 11.7 percent (Bahraich district) to as low as 1.22 percent (Hathras district) of geographic area. In terms of wetland area, Sonbhadra district has highest share (5.08 percent) of total wetland area of the state. This is mainly due to a number of reservoirs present in this district. There are 699 reservoir/barrage in this district including Rihand, constructed over Rihand River that account for 66 percentage of total wetland area district. The other major contribution is from river/stream, Sone river being the main. Thus, this is mainly a wetland district belonging to man-made category.
Baghpat and Hathras district have the least share of wetlands. The districts with very high concentration of small wetlands (2.25 ha) are Siddharthnagar, Azamgarh and Jaunpur with 3657, 3406 and 3301 numbers respectively, while Baghpat district has the lowest with 365 such wetlands.

Ramsar Sites of U.P.
Uttar Pradesh with 10 Ramsar sites is the state with highest number of Ramsar ites in India. In 2021 four new sites were added that includes thol and Wadhwana from Gujarat and Sultanpur and Bhindawas from Haryana. The surface areas covered by Ramsar Sites are around 1,083,322 ha. The upper ganga river that stretches from Brigghat to Narora became the first wetland to acquire the status of Ramsar site. It was the only Ramsar site till 2019.

Sarsai Nawar Jheel
Sarsai Nawar wetland is located in etawah district of Uttar Pradesh.in 2019 this jheel was designated as Ramsar site. Internationally it is recognized as a bird sanctuary.It is a permanent marsh.Humans and wildlife live in coordination with each other. A particular beneficiary is the vulnerable Sarus crane with a population of 400 individuals making up the largest flock in the region. White rumped vultures and woolly necked stork are also present which are critically endangered species.

Haiderpur wetland
Haiderpur wetland is a UNESCO Ramsar site located near the Bijnor Ganga Barrage within the hastinapur Wildlife sanctuary in Uttar Pradesh.
The wetland is home to over 320 species of birds, which includes many globally threatened species. Commonly observed avian species includes, Partridge, Quail, Peafowl, Falcon, Hawk, Spot –billed duck, Crane, Eagle, Owl, white vulture, Cuckoo and Nightingale, Kingfisher, Myna, Red –vented bulbul, Sparrow, Baya weaver among others are also found in abundance in the wetland.

Sur Sarowar wetland
Sur sarowar also known as Keetham lake is a human made reservoir; originally created to supply water to the city of Agra in summer, the wetland soon became an important and rich ecosystem. The Site's patchwork of different habitat types provides refuge to resident and migratory birds, and more than 60 species of fish. Threatened species include the vulnerable greater spotted eagle (Clanga clanga), sarus crane (Grus antigone) and catfish Wallango attu. The site is important for bird species which migrate on the Central Asian flyway, with over 3000 waterbirds known to visit the reservoir.

Bakhira Sanctuary

The Bakhira sanctuary is the largest natural flood plain wetland of Inda in Sant Kabir Nagar district of Eastern Uttar Pradesh. The sanctuary was established in 1980. It is situated 44km west of Gorakhpur city and 55km away from basti. It is vast stretch of water body expanding over an area of 29km square. This is an important lake of eastern UP, which provides a wintering and staging ground for a number of migratory waterfowls and a breeding ground for resident birds.This is also used for farming activities as it is connected to Bakhira canal which covers the people of 15km from its origin. The sanctuary is named after the village Bakhira located adjacent to the lake along with as many as hundred eight villages surrounding the lake within 5km radius. The villagers from the surrounding village depand on the wetland for their livelihood in the form of fishing, agriculture activities and fuelwood collection from it. The Siberian birds travel across 5000km to get to these wetlands at the time of winters.

Best time to visit the Bakhira Lake is in winters Nov – Jan. During this time migratory birds from Tibet, China, Europe & Siberia come here, covering about 5000km.

Parvati Agra bird Sanctuary

Parvati bird sanctuary is situated in Gonda district of Uttar Pradesh.it is about 45 km. from Gonda Mankapur Nawabganj Road. The sanctuary is spread over an area of 1084.47ha. During winter season many migratory birds visit every year. Parvati agra bird sanctuary was declared vide Government.Notification No.1021/14-3-14/90 dated 23-05-1990. The sanctuary consists of two lakes i.e Parvati and Agra situated about 1.5 km.apart. it is in the Upper Gangetic Plains moist deciduous forests ecoregion. The avian population of the bird sanctuary is a mix of about 35 species of residents as well as migratory birds.

Saman Bird Sanctuary

Saman bird sanctuary is situated in the mainpuri district of Uttar Pradesh. it is a seasonal oxbow lake on the Ganges floodplain. It is heavily reliant on the arrival of the south –westerly monsoon in july and august, hich provides the vastmajority of annual rainfall.187 bird species have been recorded in this sanctuary. Vulnerable species including sarus crane (grus antigone)are also found. Ecosystem services provided include supply fresh water for agriculture as well as recreation and nature based tourism based around the huge diversity of bird

Nawabganj Bird Sanctuary

Nawabganj Bird Sanctuary renamed in 2015 Shahid Chandra Shekhar Azad Bird Sanctuary, is a bird sanctuary located in Unnao district on the Kanpur-lucknow highway in Uttar Pradesh, India consisting of a lake and the surrounding environment. It is one of the many wetlands of Northern India.

Samaspur Bird Sanctuary

Samaspur bird sanctuary is a protected area situated near Salon in Raebareilly district, uttar Pradesh,India. It is about122 kn from Lucknow on lucknow-Varanasi highway. It was established in 1987 as Ramsar site. Some of the birds come here from a distance of 5000km which include Greleg Googe, PinTail,Common Teel, Vision showler,Surkhab etc. Local birds include comb Duck,Whistling Teel,Spot Bil,Spoon Bill, King fisheretc. Twelve varieties offish are there in the lake Samaspur.

Upper Ganga River

The upper Ganga river, the stretch from Brigghat to Narora, was declared the state's first Ramsarr site in 2005. A Ramsar site is a wetland designated to be of international importance under the Ramsar Convention signed in Iran in1971. It is around 265.90sq km. The 85 km long river stretch of upper ganga and 2,073 sq km Hastinapur wildlife sanctuary cover parts of Bijnor, Meerut, Hapur, Amroha, and Muzaffarnagar.

The whole stretch of river ganga (main stem) has three segments:

*A. Upper Ganga = 294 km Gaumukh to haridwar

* B. Middle Ganga = 1082 km Haridwar to Varanasi

* C. Lower Ganga =1134 km Varanasi to Ganga Sagar.

Upper Ganga River serves as a home for International Union for Conservation of Nature (IUCN) red-listed Ganges River Dolphin, Gharial, and crocodile.

The river is also a shelter for six species of turtles, 82 species of fish, and more than a hundred species of birds. Major plant species are Dalbergia sissoo, Saraca indica, Eucalyapus globules, Ficus bengalensis,Aquatic Eichhornia etc.

Sandi bird Sanctuary

Sandi bird sanctuary is a bird sanctuary in Hardoi district of Uttar Pradesh. The sanctuary is located at a distance of 19 km on Hardoi-Sandi Road in Sandi Hardoi district of Uttar Pradesh. Sandi Bird Santuary in 1km from Sandi town on Main Road at Nawabganj, near Sandi Police Station of Hardoi district.


Ganga river
Sharda river
Nepal
Dhla
Patana
Sandi
Saman
Sur-Sarovar
Lakh-Bahosi
Parvati Arga
Lucknow
Bakhira
Chambal
Nawabgani
Samaspur
Yamuna river
Surhatal
Bihar
VijaySagar
Madhya Pradesh

Fig 1

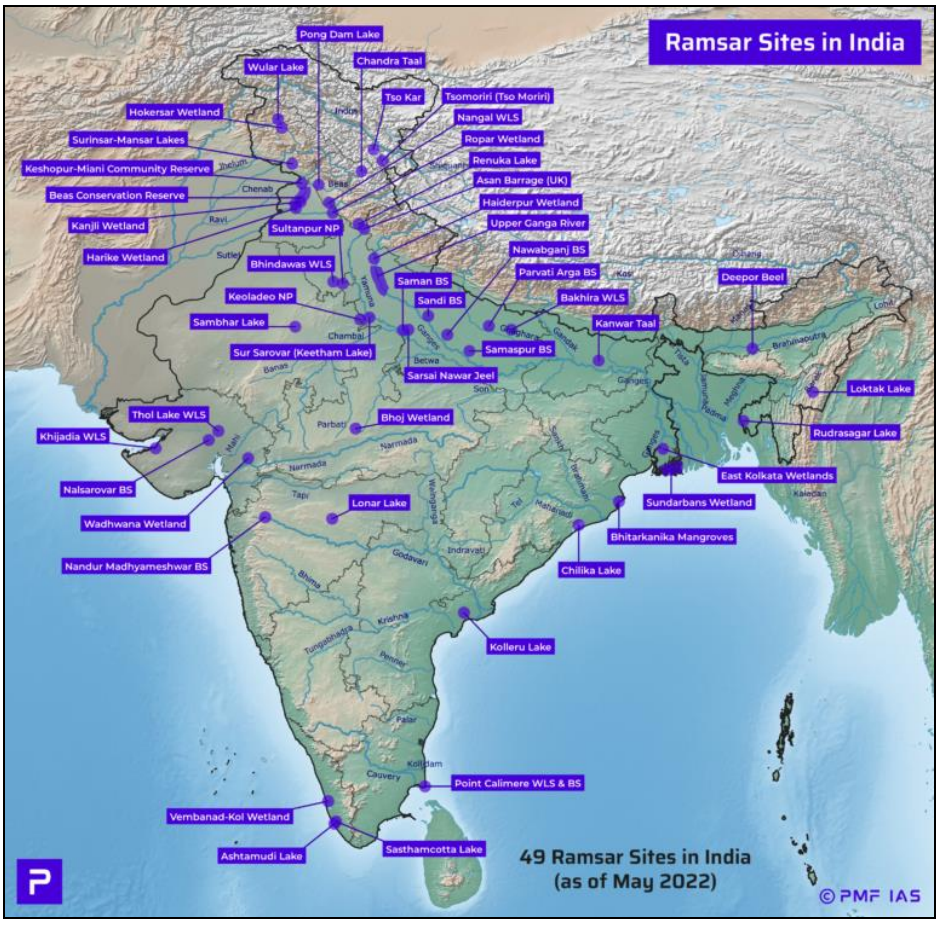
Ramsar Sites in India
Pong Dam Lake
Chandra Taal
Wular Lake
Tso Kar
Tsomoriri (Tso Moriri)
Hokersar Wetland
Nangal WLS
Surinsar-Mansar Lakes
Ropar Wetland
Keshopur-Miani Community Reserve
Renuka Lake
Beas Conservation Reserve
Asan Barrage (UK)
Haiderpur Wetland
Kanjli Wetland
Sultanpur NP
Upper Ganga River
Harike Wetland
Nawabganj BS
Bhindawas WLS
Parvati Arga BS
Deepor Beel
Saman BS
Keoladeo NP
Sandi BS
Bakhira WLS
Sambhar Lake
Kanwar Taal
Samaspur BS
Sur Sarovar (Keetham Lake)
Sarsai Nawar Jeel
Loktak Lake
Thol Lake WLS
Bhoj Wetland
Rudrasagar Lake
Khijadia WLS
East Kolkata Wetlands
Nalsarovar BS
Sundarbans Wetland
Lonar Lake
Wadhwana Wetland
Bhitarkanika Mangroves
Nandur Madhyameshwar BS
Chilika Lake
Kolleru Lake
Point Calimere WLS & BS
Vembanad-Kol Wetland
Ashtamudi Lake
Sasthamcotta Lake
49 Ramsar Sites in India
(as of May 2022)
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Fig 1

Stressors of wetlands: wetlands are under great stress now a days. Approximately 35 %of the worlds wetlands were lost between 1970-2015 with annual rates of loss accelerating from 2000(global wetland outlook). Main stressors of wetlands are climate change, population explosion, urbanization, industrialisation, unsustainable use, pollution, invasive species, disrupted flows from dams and sediment dumping from deforestation and soil erosion. Water pollution and nutrient loading from fertilizers are among the biggest challenges.

Wetland conservation and management strategies: wetlands are essential for our planet to flourish biodiversity. Studies show the economic value of services provided by wetlands far exceeds those of terrestrial ecosystems. Inland wetlands,for example, have a total economic value five times higher than tropical forests, the most valuable terrestrial habitat. More than 25% of all wetlands plants and animals are at risk of extinction. The IUCNs red list index which assess survival probability using available data have identified negative trends for wetland mammals, birds, amphibians and corals,and indication they are heading for extinction. In view of all it is mandatory to conserve these valuable wetlands. Wetland conservation is aimed at protecting and preserving areas where water exists at or near the earth surface. Wetland systems directly or indirectly supports billions of people by providing goods and services to them. India is having a rich heritage of numerous rivers and streams like GANGA, YAMUNA, NARMADA, TAPTI, GOMTI, BRAHMPUTRA, KAVERI etc. So wetland management is quite essential. A wetland management program generally involves activities to protect, restore manipulate, and provide for functions and values emphasizing both quality and acreage by advocating their sustainable uses (walters, 1986). Management of wetland ecosystems require intense monitoring and increased interaction and cooperation among various agencies such as state departments concerned with the environment soil agriculture, forestry, urban planning and development, natural resource management; public interest group; citizen group; research institutions; and policy makers.

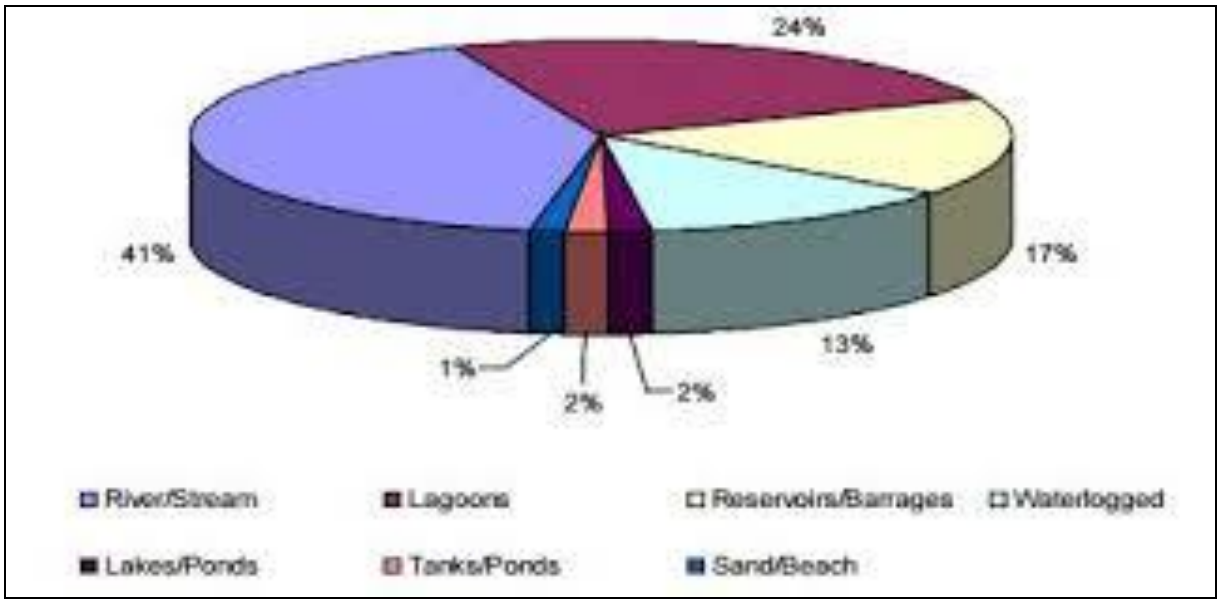

Fig 2

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