Comparative Ecology, Issues and Current Conservation Scenario of Ramsar Sites of Rajasthan

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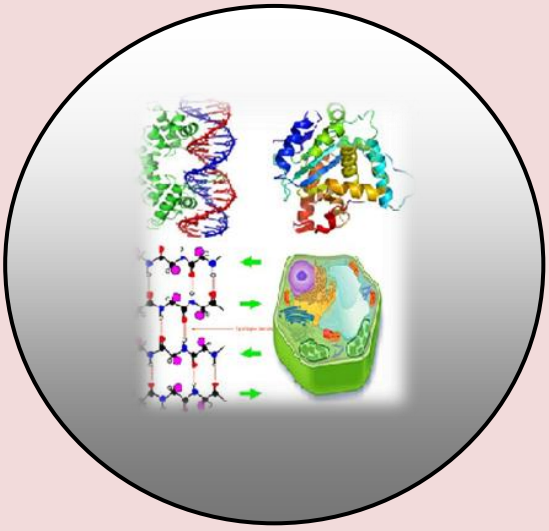

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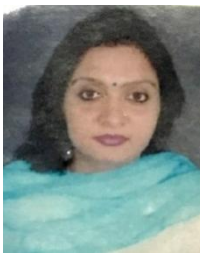

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RESEARCH PAPER

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Comparative Ecology, Issues and Current Conservation Scenario of Ramsar Sites of Rajasthan

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ABSTRACT

Wetlands serve as unique ecosystems that host characteristic vegetation and fauna. Since their importance to environment, wetlands around the world have been conserved and protected under Ramsar Convention (1971). Out of total 2331 Ramsar sites all over the world, India hosts 26 sites, out of these; the state of Rajasthan contains two Ramsar sites namely, Keoladeo National Park and Sambhar Lake. These sites support lives of immense number of birds and other animals. Despiterigorous legislation and efforts made by government, environmentalists and other stakeholders, unbalanced agricultural regime and non-sustainable land use pattern around these sites have created unconstructive ecological changes. For instance, Keoladeo National park had faced serious ecological concerns due to invasive grass species which made it unsuitable for migratory Siberian cranes. The scientific work addressing the need of conservation of wetland ecology, has been elaborately addressed on the global extent, but being unique ecological structure of desert state of Rajasthan, its categorical ecological issues have not as much been addressed previously. The present effort attempts to accomplish the same. The present work observes the causes and impacts of ecosystem changes for these sites. The paper additionally suggests some consequential remedies to conserve these sites.

Key words: Wetlands, Sustainable Development, Migratory Birds and Conservation Strategy.

INTRODUCTION TO WETLANDS

Wetlands are relegated as ecotonal or transitional zone between permanently aquatic and terrestrial ecosystems. Wetlands are landforms where saturation with water is the ascendant factor for determining the nature of soil type and consequent types of plant and animal communities and ecology of the ecosystem. Wetlands are found on each part of the planet from the tundra to the tropics and on every continent except the polar Antarctica. In Clean Water Act (1972), of USA the term wet land means *"those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas."* In India Wetlands (Conservation and Management) Rules, 2017 state "*wet land" means an area of marsh, fen, peat land or water; whether natural or artificial, permanent or temporary, with water 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, but does not include river channels, paddy fields, human-made water bodies/tanks specifically constructed for drinking water purposes and structures specifically constructed for aquaculture, salt production, recreation and irrigation purposes;*".

Wetlands (Conservation and Management) Rules, 2017 provide the constitution of State Wetlands Authority within each of the state of India and a National Wetlands Committee for formulation of principles and their implementation for conservation and wise use of wetland system in India.

Ramsar Sites

Since their importance to environment, wetlands around the world have been conserved and protected under Ramsar Convention (1971), after the name of the place in Iran. The Ramsar Convention (1971) has defined wet lands as "*areas of marsh, fern, peat land or water, whether natural or artificial, permanent or temporary, with water 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*".

The Ramsar Convention itself stresses the desideratum for conventional monitoring to detect authentic or potential transmutation in the ecological character of listed sites. India joined the convention in 1981. Out of total 2331 Ramsar sites all over the world, India hosts 26 Ramsar sites, out of these; the state of Rajasthan contains two Ramsar sites namely, Keoladeo National Park and Sambhar Lake.Rajasthan has mainly inland type of wetlands. India is the only country which has the most heterogeneous types Ramsar sites. These sites include high-altitude wetlands, mangroves, estuaries, oxbow type of wetlands, urban and rural wetlands. Through designating a Ramsar site, authorities and other stakeholders promote the conservation and justified use of such systems. Stakeholders for such implementation of plan for conservation are government, local communities, ecologists, environmentalists, NGOs and corporates. The site is under threat or has vulnerable ecosystem then it finds its place under Montreaux Record. The Montreux Record is a register of wetland sites on the List of Wetlands of International Importance where perturbations and negative changes in ecological systems character have taken place or in process of occurring, or is likely to occur as a result of technological developments, changes in land use pattern, habitat destruction, pollution or other anthropogenic interferences (Kulshreshtha, 2006). Three sites of India are in the list of the Montreux record which are Keoladeo National Park, Chilika Lake and Loktak Lake, which shows the negligent approach of State and stakeholders towards preservation of wetlands.

Comparative Ecology of Ramsar sites of Rajasthan

Thetable 1 summarizes the geography, ecology and biodiversity of both of the Ramsar sites (Sharma and Kulshreshtha, 2013).

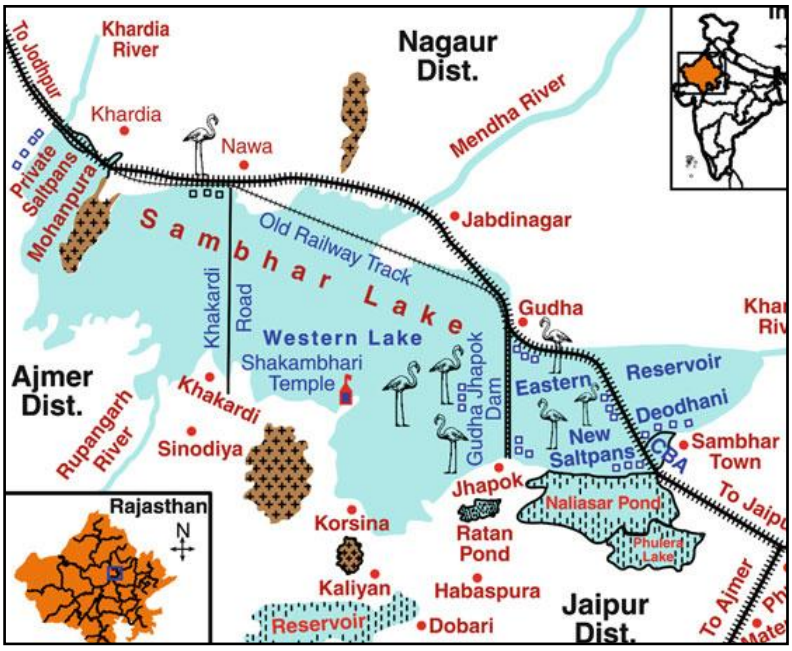

Figure 1. Sambhar Lake Ramsar Site (Sharma et al., 2013)

Table 1. Ecology of Ramsar Sites of Rajasthan.

COMPARATIVE STUDY OF GEOGRAPHY, CLIMATIC FACTORS, ECOLOGY AND BIODIVERSITY[1]

S.N.	Characteristic	Sambhar Lake	Keoladeo National Park
1	**Introduction**	Largest inland saline lake of India, About 60 km South West of Jaipur, Declared Ramsar site in 1990 Important Bird Area (IBA) by BNHS in 2004. Salt production is as old as 1500 years	Ramsar Site in 1981 National Park status 1981 World Heritage site in 1985 Listed in Montreaux Record
2	**Geography**	**Location:** Situated in Jaipur, Ajmer, and Nagaur districts of Rajasthan at 25^{0}52′ N-27^{0}02′ N, 74^{0}54′E-75^{0}14′E **Max size** : 230 sq Km	**Location:** Situated at the confluence of the Gambhiri and Banganga Rivers (27° 07′ 06″–27° 12 ′ 12″ N latitude and 77° 29 ′ 05″–77° 33 ′ 09″ E 2 Km Southwest to Bharatpur **Max Size**: 29 sq km
3	**Water resources and catchment**	**Catchment area**: 5708 sq km in Jaipur (34%), Ajmer (18%) and Nagaur (18.26%), Sikar (29.20%) districts **Ephemeral streams**: Rupargarh (south), Mendha (North) Kharian (North west), Khandel (East) **Rainfall streams**: Ruprail, Bandi, and Turatmati. **Paleochannels**: Anokhi and Ranoli—the two major tributaries of River Mendha	A river run dry the wetland is a natural reservoir of excess water from karauli district via the **Gambhiri river** in July. The river comes up to Sewla, 18 km from the park. From here, the **Pichuna canal** carries it to **Ajan bund**, 1 km from the park. In villages of the Gambhiri flood-plain, its water reduces soil salinity. The bund is usually flooded to the depth of two meters maximum throughout the monsoon season (July–September). From February onward, it begins to dry up and by June, water is seen only in a few pockets
4	**Climate**	Semi Arid Subtropical dry and hot Temperature in summer 45-48^{0}C and in winters 5-20^{0}C	Semi Arid
5	**Rainfall**	**Average rain fall**: 100 to 500 mm, 80% of rainfall in July to October Frequent draughts	Average rainfall: 662mm RH 62% in March and 83% in December
6	**Flora**	Most flora flourish during rainy season when salinity is low. **Phytoplanktons**: 13 species **Macrophytes**: *Salsola* and *Suaeda* species **Vegetation**: Thorny shrub *Anogeissus pendula*, *Boswellia* sp, *Prosopis spicigera*, *Acacia nilotica*, *A. senegal*, *Capparis deciduas, Salvadora persica, S. olioides,* **Grasses** *Saccharum spontaneum and S. benghalense and Cenchrus*	**Xerophytic vegetation** *Acacia nilotica*, *Prosopis cineraria* , *Salvadoraoleoides*, *Capparis decidua* , and *C. seperia* *Ziziphus mauritiana* *Salvadora persica* *Mitragynaparvi flora* *Syzygium cumini* *Salvadora persica* *Capparis sepiaria* *Prosopis juliflora.* **Physiognomic types** Forest, woodland, scrub

			woodland, savanna woodland, tree savanna, shrub savanna **Grasses** *Khus* grass *(Vetiveria zizanoides)*
7	**Fauna (Invertebrates)**	Zooplanktons, aquatic beetles	Worms, Insects, Molluscs Tortoise Beetle (*Cassidacircumdata*)
8	**Fauna (Vertebrates other than Birds)**	Fishes found in streams in rainy seasons and die in lake due to high salinity. Amphibians like *Euphlyctis hexadactylus* and *Bufo*s p. are found in catchment streams. Small mammals like rat and squirrels are found Nilgai (*Boselaphus tragocamelus)* Leopard (*Panthera pardus)* Striped Hyena (*Hyaena hyaena)* Golden Jackal (*Canis aureus)*, Hanuman Langur (*Semnopithecus entellus)* Rhesus Monkey (*Macaca mullatta)* Common Palm Civet (*Paradoxurus hermaphrodites)* Bengal Fox (*Vulpes bengalensis)* Indian Grey Mongoose (*Herpestes edwardsii)* Indian Hare (*Lepus nigricollis)* Indian Flying Fox (*Pteropus giganteus)*	27 species of mammals Sambar Chital Nilgai Blackbuck Wild Boar Golden Jackal Striped Hyena Jungle Cat Fishing Cat Common Civet Smooth–coated Otter
9	**Avifauna**	**52 Avian species** (41 Resident and 11 winter visitors) Act as wintering grounds for the flamingos • Greater Flamingo *Phoenicopterus roseus* • Lesser Flamingo *Phoeniconaias minor* Other important birds are Crested Lark, Sociable Lapwing Baya (*Ploceus megarhynchus)* and Desert Wheatear	**More than 350 species of birds** Migratory waterfowl of 21 species Wintering ground for Siberian Crane until 2003 (see the source paper for complete list for avifauna)
10	**Threatened species (or species require attention)**	**Critically Endangered:** White-rumped Vulture (*Gyps bengalensis)* White-naped Tit *(Parusnuchalis)* **Near Threatened:** Painted Stork (*Mycteria leucocephala)* Lesser Flamingo (*Phoeniconaias minor)*, Cinereous Vulture (*Aegypius monachus)* Red-headed Vulture (*Sarcogyps calvus)*	15 Globally Threatened bird species 12 Near Threatened species **Critically Endangered:** White-rumped Vulture (Indian White-backed Vulture) (*Gyps bengalensis*) Long-billed Vulture (*Gyps indicus*) Siberian Crane (*Leucogeranus leucogeranus*) Sociable Lapwing (*Vanellus gregarious*) and Red-headed Vulture (*Sarcogypscalvusto*)
11	**Potential threats to Ecosystem**	Shrinkage of water Irregular land use Deforestation Proposed Solar large Plant	Scanty water *Invasive Prosopis juliflora* *Invasive Paspalum distichum* Irregular land use

[1](Sources of information: B.K. Sharma et al. (eds.), *Faunal Heritage of Rajasthan, India: Conservation and Management of Vertebrates published by* Springer International Publishing Switzerland 2013)

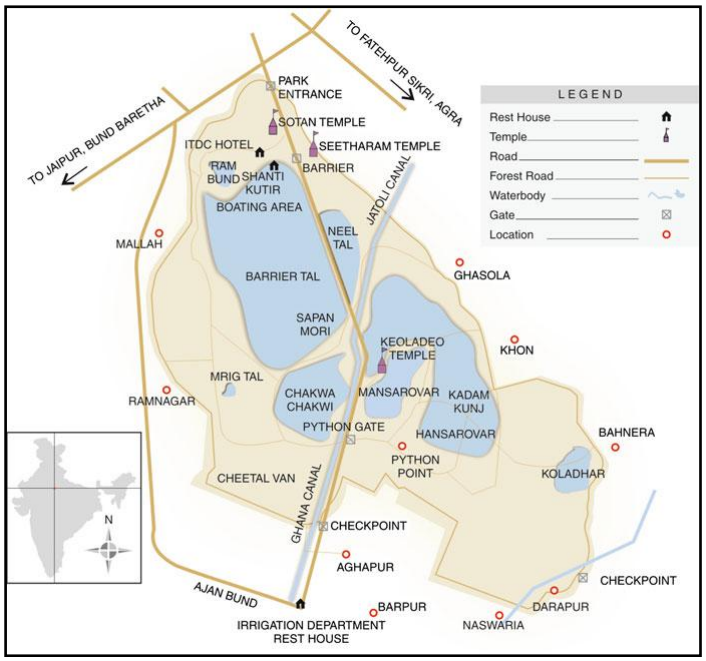

Figure 2. Keoladeo Ramsar Site*.
(Source*** Sanctuary Asia Photo Library)**

Current Scenario of Sambhar Lake site

It is currently facing severe anthropogenic pressure and conservation-related problems resulting into a rapid degradation of lake. We should soon execute reclamation work plan for the site to save its ecological system and biodiversity. Sharma (2013) expressed fear that "*If the situation continues, it might face the fate similar to the Deedwana Lake which has totally disappeared.*" Currently, the Sambhar lake site is under major problems which are discussed in following section.

1. Siltation and disturbances in the lake bed

The main lake bed soils are badly exploited for procuring soil for construction purposes by the villagers in the of Nawain Nagaur district. Large amount of silt in the lake bed is negatively affecting its ecology.

2. Sacrcity of water

There are large number diversions made by irrigation department in the catchment rivers. Scarcity of water and disturbed water catchment area is affecting the near forest cover.

3. Road Construction

According to Sharma (2013) "*The most devastating anthropogenic action has been the construction of 12.4-km road from Nawa to Khakarki village near Korsina in the southwest of the lake, dividing the lake bed into two unequal parts This may severely affect the population of the migratory avifauna*".

4. Illegal Salt Production and Large number of Bore wells

Rampant illegal salt production and groundwater extraction have dried up the lake, according to a 2008 study by Desert Regional Station of Zoological Survey of India. Illegal production of salt has threatened the lake's rich ecology. According to the study, in 1982-83, more than 500,000 flamingos visited the lake, their number reduced to 20,000 in 2008. Ecologists accused that unauthorised salt manufactures are digging bore wells in the lakebed and laying pipelines, which sometimes extend to several kilometres across the lake, to extract the brine. This practice is rampant along the lake bordering Naguar and Ajmer districts. A fact-finding committee formed by the state government, said in a report that about 2000bore wells were operating in the lakebed, which are shrinking the water resources for the lake. Here, it is recommended to practice biological management of salt work by introducing the right kind of brine shrimp *Artemia* strain that will feed on the micro algae and thus quality of salt could be enhanced.

The brine shrimp introduction will in turn help to renew the wet land ecosystem, which forms the feeding ground for flamingos. The bittern from salt-lake could be isolated to produce magnesium ammoniumphosphate as chloride free fertilizer. However, the presence of brine algae in Sambhar salt-lake is considered as goldmine for extracting beta-carotene for future course of action on techno-commercial basis.

5. Construction of Solar Plant

The world's largest photovoltaic (PV) solar power project has been sanctioned near Sambhar Lake, which is to provide 4,000 MW electricity. Many ecologists and environmentalists have issued their concerns regarding its negative impacts on ecological balance for the lake.

Current scenario of Keoladeo National Park

KNP is also facing serious issues regarding its ecological balance due to various factors. Such factors were led to decrease in incoming Siberian cranes here. Yearly studies done by Vijayan et al and KNP Forest department has reported continuous decrease in wintering population of Siberian Crane which grounded to zero in 2003. The following factors have contributed to perturbation in the wetland ecosystem.

1. Invasion of Prosopis juliflora

Siberian cranes feed primarily on the tubers of sedges *Vetivera*, a kind of grass. Due to scarcity of water in the KNP, invasive *Prosopis juliflora*, the invasive grassy weed proliferated dengerously that obstructed the growth of plants providing food for the cranes (Vijayan, 1991). The park received in past a mere 18 million cubic feet (mcf) in 2004, against a required 550 mcf. Such scarcity of water encouraged the growth of dry land grasses and the invasive trees *Prosopis juliflora* are slowly taking over the land, marking changes in the wetland's ecology. Fig. 2 expresses the outcome of study done (Mukharjee, 2017), that quantum of invasion by *P. juliflora* that drastically leads to changes in plant community structure.

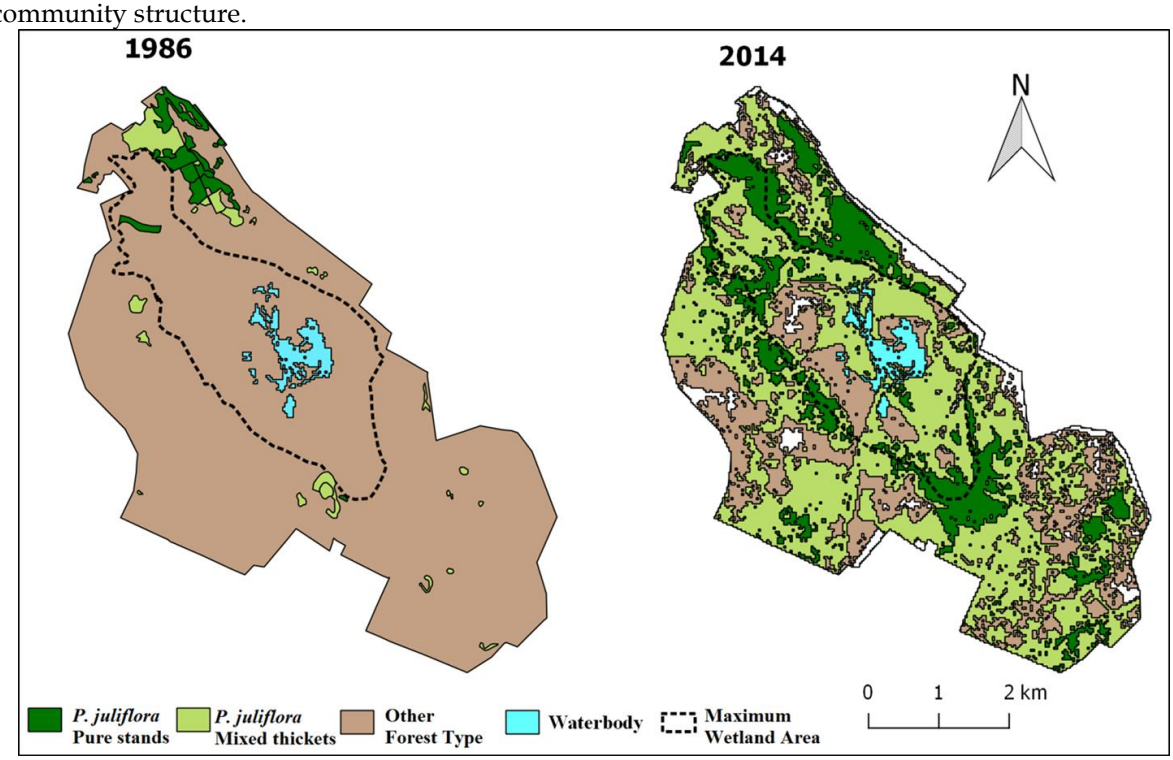

Figure. 2 Invasive *P. juliflora* at KNP[2].

Source: [2] (Mukharjee et al, 2017)

Uprooting of every individual plant of *P. juliflora* is the only solution to this problem, it is to be noted that crores of plants are growing in the national park.

2. *Scarcity of water*

Decreased water supply to the wetland is seriously affecting the ecosystem at KNP. Gambhiri River is presently the main source for the park and its supply is decreased due to construction and subsequent increase of height of Panchana dam, which is diverting water for agricultural purposes (Sharma, 2013). In villages water of Gambhiri River reduces salinity of soil, so farmers demand earlier diversion of water to their fields rather than to park itself. A piped channel has been proposed by the state government but ecologists and forest officials say that piped water would be biologically dead -- devoid of any algae, protozoa, plankton or fish. While river water brings in about 37 fish varieties, only six types can breed in the park. Moreover, storing water in the park would change it from a wetland to a lake.

3. Invasion of *Paspalum distichum*

Invasion of *Paspalum*, another invasive grass is competing for tuberous macrophytes and replacing them, which is food for waterfowls. Earlier this grass was under control due to management by cattle grazing.

CONCLUSIONS

Both Ramsar sites of Rajasthan are currently facing serious ecosystem challenges regarding scarcity of water, pollution, invasive species of weeds and changed land use pattern due to agriculture and urbanization. The conditions are more than serious. Large ecological changes have led the KNP site to include this site in the Montreaux Record. Ecologists fear that due to large infamous events in KNP, it may lose its World Heritage site status. All stakeholders should come together to develop a work plan for issues responsible for ecological crisis in these sites.

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