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Assessment of Ecological Stressors and its Influence in the Functional Evaluation of Rural Wetlands in Tirunelveli District, Tamilnadu, India

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***Abstract*: Ecological stressors in wetland Tanks of southern part of Tirunelveli were studied. Extraction of water for Irrigation and presence of invasive species were most prominent among the disturbances observed during the study. Bird diversity was rich and abundance higher in the tanks with fewer stressors. Ecological attributes could effective in determining the status of wetlands.**

***Keywords*: Ecological Stressors**

1. Introduction

Wetlands are the link between land and water, and are some of the most productive ecosystems in the world. Wetlands have many important functions like providing habitats, store water, replenish ground water levels, prevent erosion, control flood in addition serve as places of recreational activities. However, these ecosystems are vulnerable and particularly susceptible to changes in quantity and quality of water supply which are influenced by natural and anthropogenic factors (IPCC 1990). Though, ecologists warn the likely pronounced effect of climate change on the wetland by alterations in hydroperiod regimes, there are also human induced changes (eg. land use change) that would have direct and indirect impacts on the quality of the tanks (Burkett and Kusler 2000, Ferrati et al. 2005). India, with its annual rainfall of over 130 cm, varied topography and climatic regimes support and sustain diverse and unique wetland habitats. Natural wetlands in India consists of the high altitude lakes, wetlands situated in the flood plains of the major river systems, saline and temporary wetlands of the arid and semi-arid regions, coastal wetlands such as lagoons, backwaters and estuaries; mangrove swamps and marine wetlands.

Wetlands are dependent on inflow of water from various sources and hydrology is regarded as vital factor that could contribute to the sustenance of wetland soils and the development of biotic communities. Physical form (area and shape) and the water quality properties are other factors that determine the status of wetlands. Ecological parameters are essential in defining the quality of wetlands. Assessment systems framed to evaluate the status of aquatic systems include ecological features defining their state and condition. They form the basis to the understanding of the ecological wellbeing of the water bodies under study.

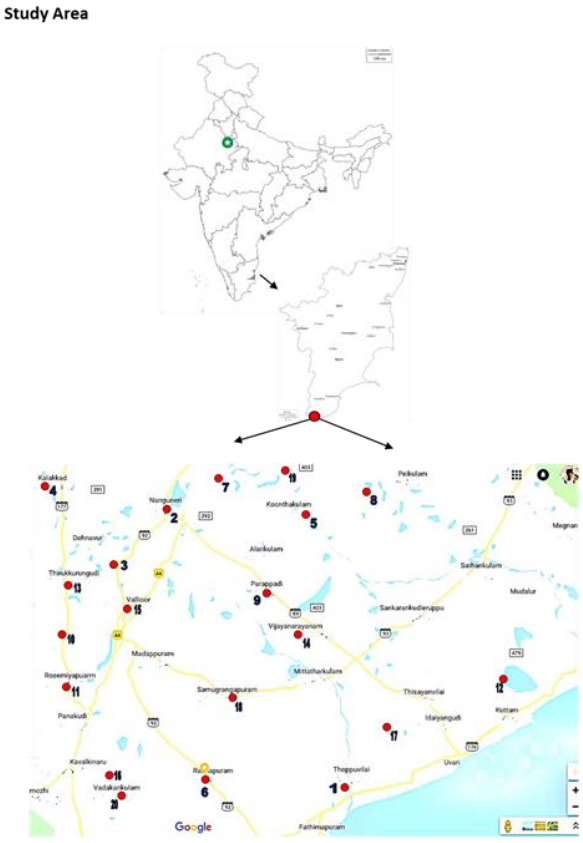

Fig. 1. Study area

We surveyed and studied the ecological stressors of wetland tanks in southern part of Tirunelveli District, Tamilnadu with

the objective of its utility in the assessment of wetland ecological health. Water fowls are the indicators of the fishes. During the period of survey on the ecological attributes of the different tanks in the study area, the birds count was done. Water birds have been defined as "species of bird that are ecologically dependent on wetlands". This is the definition used by the Ramsar Convention on Wetlands. Over the last decade, one of the most significant, large-scale bird-count programmes is the Asian Waterfowl Census. The scheme was initiated by the International Waterfowl and Wetlands Research Bureau (Urfi et. al 2004).

2. Materials and methods

A. Study area

The extreme tip of the South India was selected for the study and 20 tanks from different geographical area were chosen especially from the Tirunelveli distirct, Tamilnadu.

Most of the tanks in this region are utilized for irrigation. Birds occupying and visiting the tanks were counted directly during the morning (06:00-10:00 hr) and evening (16:00-18:00 hr) using binoculars. Counting was also achieved during other time periods of the day by walking at a slow pace along the bank of tanks. Details related to identification and ecological and migrant status of birds were consulted with standard literature (Ali and Ripley 1987; Manakadan and Pittie, 2001).

Ecological attributes were recorded to evaluate the impact of the system. Factors included in the assessment were chosen in such a way that they could be visually observed and noted. The criteria included are i) Mining – removal of soil layer, excavation. ii) Soil Erosion – Soil erosion, bank instability, iii) Sewage and Waste disposal – sewage and domestic waste reach through drain, iv) Invasive species- invading plants (Water Hyacinth,) and animals like fishes (Tilapia, Sailfin fish), v) Grazing – cattle grazing. vi) Defecation - open defecation vii) Washing/bathing – utilized by people nearby, viii) Water extraction – for irrigation, construction purpose and ix) Encroachment – cultivable lands encroaching wetland, construction of public utility buildings like bus terminals, toilets.

3. Results and discussion

During this study we assessed the attributes that could affect the ecological state of the tanks of Southern part of Tirunelveli

Table 1
List of tanks surveyed for the ecological factors

S. No.	Tank Name	Place	Bird species
1	Chempalaikulam	Chempalaikulam	4
2	Chetruthamarikulam	Nanguneri	5
3	Ponnathikulam	Eruvadi	3
4	Salaiputhurkulam	Kalakkad	3
5	Koonthankulam	Koonthankulam	22
6	Mahendrapuram	Radhapuram	2
7	Mullukulam	Mullukulam	6
8	Munanjipatti	Munanjipatti	2
9	Parappadikulam	Parappadi	3
10	Palliyarukulam	Rajaputhur	5
11	Parivirisuryankulam	Rosmiyapuram	5
12	Periya Tharuvai kulam	Periyatharuvai kulam	6
13	Periyakulam	Thirukurunkudi	6
14	Periyakulam	Vijayanarayanam	15
15	Periyakulam	Vallioor	8
16	Pillaiyarkudieruppukulam	Pillaiyarkudieruppu	4
17	Pulimankulam	Pulimankulam	6
18	Samugarengapuram	Samugarengapuram	4
19	Unnankulam	Unnankulam	13
20	Vadakkankulam	Vadakkankulam	4

Table 2
Ecological criteria assessed during the study

	Stress factors	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	Mining (Excavation)	-	+	+	+	-	+	-	+	+	+	+	+	+	+	+	+	-	+	-	+
2	Soil Erosion	-	+	+	+	-	+	+	-	+	+	+	-	+	+	+	-	-	-	-	+
3	Sewage & Waste disposal	-	+	+	+	-	+	-	+	+	-	-	+	-	-	+	+	-	-	+	+
4	Invasive species	+	+	+	+	+	-	+	+	-	+	+	+	+	+	+	+	+	+	+	+
5	Grazing of cattle	+	+	+	+	-	-	+	+	+	+	+	+	-	+	+	+	+	+	+	+
6	Defecation	-	+	+	-	-	+	-	-	+	-	-	+	-	-	+	+	+	+	-	+
7	Washing/bathing	+	+	-	-	-	+	-	+	+	+	-	+	+	+	+	+	+	+	+	+
8	Water extraction for Agriculture	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
9	Encroachment	+	-	+	+	-	-	+	+	+	+	-	+	-	-	+	+	+	-	-	+

Distirct of Tamilnadu (Table 1). Tanks that had few stressors had natural habitats supporting biodiversity and providing more ecological functions. Most of the wetland tanks have been utilized for irrigation and for regular domestic use of the people nearby. The most prominent disturbance observed in the tanks was water extraction for Irrigation, spread of invasive species, grazing of cattle, use for bathing and washing (Table 2).

Konnthankulam (Tank 5) had fewer ecological stressors and this tank has been utilized for irrigation. Few tanks that were close to villages and and places with frequent human movements had more impact. Chetruthamarikulam and Valliyoor big tank are under stress from all the ecological stressor selected during this study. Survey on the water birds in the region showed that tanks that had minimal ecological stress supported more diversity and abundance. Ardeola grayii (Indian Pond Heron) was the most common and abundant species in all the tanks surveyed. Waterbirds can maintain the diversity of other organisms, control pests, be effective bioindicators of ecological conditions, and act as sentinels of potential disease outbreaks (Green et al. 2014). Few migrant species like Greater Flamingo, Glossy Ibis, Comb Duck, Northern pin tail were observed in Konthankulam (Tank 5) and Vijayanarayanam tank (Tank 14). Koonthankulam (Tank 5) is a bird sanctuary which initially was a community protected area now is under the protection of Tamilnadu state Forest department. The knowledge of the characteristics of bird communities found in each habitat type and the ecological requirements of each species helps to define the environmental conditions of an area. (Ruiz-Esparza 2016). Due to their importance to the livelihood of the local communities, wetlands have been exposed to anthropogenic activities that pose potential threats to biological diversity (Philemon w et. al 2018). All wetlands are local and require protection or restoration at appropriate regional and local scales (Moomaw et al. 2018).

Stressors were related to bird diversity to explain the impact on the biodiversity and the system. Human activities such as habitat destruction, pollution and land use change have imperiled both the terrestrial and aquatic habitat systems. Mounting pressure on aquatic resources such as wetlands could lead them devoid of their ecological functions. Knowledge of stressors is essential in developing framework for conservation management.

4. Conclusion

This paper presented an assessment of ecological stressors and its influence in the functional evaluation of rural wetlands in Tirunelveli district, Tamilnadu, India.

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