Beta Macrophyta Diversity Analysis in the Temporary Pond Habitats of Vettangudi Birds Sanctuary

Kannan Dorai Pandian
Thiagarajar College, India

Mahesh Mony
Thiagarajar College, India

The XXIV International Grassland Congress / XI International Rangeland Congress (Sustainable Use of Grassland and Rangeland Resources for Improved Livelihoods) takes place virtually from October 25 through October 29, 2021.

Proceedings edited by the National Organizing Committee of 2021 IGC/IRC Congress

Published by the Kenya Agricultural and Livestock Research Organization

Beta macrophyta diversity analysis in the temporary pond habitats of Vettangudi Birds Sanctuary

Kannan Dorai Pandian and Mahesh Mony

*Thiagarajar College, Madurai

Abstract

Three temporary ponds of Vettangudi birds sanctuary situate in very close proximity, located in Sivaganga District, Tamil Nadu state of India. However similar eco-climatic conditions prevailing at these pond habitat, those ponds experience the varying nature of biotic interactions. Since the habitat conditions and their land-use pattern have the major role on the vegetation diversity. Temporary ponds of Vettangudi Birds Sanctuary has the characteristic alternate drying and inundation at varying levels and this environmental condition in addition to the biotic influence over the habitat ecology and its vegetation diversity. Understanding this specific relationship is pivotal in the development of management guidelines in the pond habitat and wildlife management. The aim was to investigate the floristic composition and diversity analysis of the floor vegetation of benthic and shore-line of temporary ponds of Vetttangudi Birds Sanctuary in four different seasons in a year. A wide range of Sorenson's similarity index was found existed among the experimental ponds. Margleaf's richness index values were also observed with variations and the occurrence of floristic composition and their diversity variations were attempted to relate with the prevalent habitat conditions, experienced with varying kind of biotic influence.

Introduction

Monitoring of wetland ecology is prime important to evolve long term management of natural resources (Khan *et al.,* 2011). Faunal diversity has a strong qualitative effect on the structure of plant communities as they formed as the producer system (Gayet *et al.,* 2012) and hence, vegetation aggregation in wetland habitats is the most important determinant factor. The existence of vegetation community indicates the ecological health of wetland habitats (Lukács *et al.,* 2013) and in this context; temporary pond vegetation may play an important role in the exchange of species between water bodies at the landscape scale (Nicolet, *et al.,* 2004). The diversity of local species community has a multifaceted functioning of ecosystems (Moneterro *et al.,* 2013) significantly gets affected due to biotic interferences (Mac Arthur and Wilson 2007). Ephemeral ponds in the dry topical environment, experience alternate wet and dry climatic zone makes the ecosystem with varying vegetation diversity and the associated depending communities (Mahesh and Kannan 2018). The aggregation of floristic composition in relation to prevailing ecological conditions is essential to analyze to understand the shifting mechanism in the vegetation structure (Dé ath 2002). Therefore, it is of paramount importance to adopt habitat or ecosystem-based management, as it was suggested for hard wood temperate forest (Laflamme *et al.,* 2016). In this present investigation, vegetation analysis was done over the dry benthic surface and raised bunds region of the temporary ponds of Vettangudi Birds Sanctuary, with the objective of comparing the two different sampling zones of the three temporary ponds, lying at close proximity having varying biotic disturbances.

Materials and Methods

Three temporary ponds - Periyakollukudipatty (PKPTY), Chinnakollukudipatty (CKPTY) and Vettangudipatty (VKPTY) of a protected site to conserve avian diversity is located in Sivaganga District, Tamil Nadu, India were selected for the experiment. Semi-arid eco-climate is prevalent in the ponds. Further details on the habitat ecological conditions were provided in our previous work (Kannan and Mahesh 2016). Investigation of plant species occurred in the three experimental ponds, each at 12 randomly selected areas, over the dry benthic surface of the pond in the desiccate condition, following the summer period and over the edge of the ponds along the raised bunds using list quadrat method was done. Enumeration of vegetation species was listed in December 2013, March, June and September 2014, to cover the entire year of the investigation specific seasons. Data collected on vegetation species were used to determine Margleaf's richness index and Sorenson's similarity index.

Results and Discussion

Dry benthic surface vegetation

All–out search method was used to enumerate terrestrial vegetation emerged over the dry benthic surfaces of the experimental ponds and the investigation showed the existence of a total of 148 species included in 116 genera, belonging to 41 families. *Poaceae* family was found as dominant family with a representation of 24 species, followed by *Euphorbiaceae* family with 14 species, and Fabaceae family with 13 species. Tropical environment tends to favour to the emergence grasses, usually with a high count from *Poaceae* family (Saini *et al.,* 2010), supports the result of this study. Twenty three families were found mono-specific, represented with a single species to each family.

The occurrence of terrestrial vegetation over the dry benthic substratum of the experimental ponds showed variation between the three pond habitats in terms of the Sorenson's similarity constant (Table 1). Number of individual plant species and the number of commonly occurred similar species were found relatively higher during the December 2013 period and during the rest of the experimental periods and thus, relatively higher species variability was found between the three pond habitats, during the sampling months of March, June and September 2014.

Shore-line of raised bund vegetation

The enumeration of vegetation over the raised bund of the experimental ponds shoreline revealed the total occurrence of 185 species, included in 142 genera belong to 48 families. Among these, 17 per cent were emergent tree seedlings, 16% shrubs, 4%lianas, 13% climbers and 50% herbs were found. *Poaceae* was found as dominant family with a representation of 20 species, followed by *Euphorbiaceae* and *Fabaceae* families with 16 species to each family. Nineteen families were found mono-specific, represented with a single species to each family.

Unlike to the dry benthic substratum area, the shore-line area of the raised bunds of the experimental pond habitats showed a mixed aggregation of terrestrial plants. PKPTY pond area showed the higher number of vegetation over the raised bunds during the December 2013 period; whereas, VKPTY habitat showed higher number of terrestrial vegetation in the months of March and June, 2014. CKPTY habitat was found with the higher number of floristic species aggregation during March and June 2014; followed by September 2014 and found least in number, during December 2013. The existence of similar nature of terrestrial plant species was found in June 2014, followed during March 2014 and December 2013 between the three habitats on their shoreline of the raised bunds.

Corresponding to the larger number of individuals, Margleasf's species richness index was found higher and a declining trend on this index was noticed, whenever the occurrence of declining number of individuals (Figures 1 and 2), both in the dry substratum of the pond and the raised bund area of the analyzed habitats. The gradient of species richness among the three habitats of closely located temporary ponds could be attributable due to the varying nature of disturbances including environmental, biological and anthropogenic. Biotic attributes such as cover and species richness influence ecosystem function, as it was suggested by Galton *et al.,* (2014), could be one among the reasons for the varying response among the pond habitats. Higher rate of species richness often been shown to be beneficial, as they act as carbon sink and thereby, ecosystems become resilient (Hecks *et al.,* 2004), due to the aggregated phyto diversity, analyzed in this study.

Table 1: Sorenson similarity index using echinoderm (presence/ absence) records from the dry benthic surface and shore line reggion of raised bunds in experimental ponds

Experimentel period	Ponds	Dry benthic surface		Shore line	
		CKPTY	VKPTY	CKPTY	VKPTY
Dec'13	PKPTY	0.66	0.69	0.44	0.64
	CKPTY	1	0.74	1	0.59
Mar'14	PKPTY	0.55	0.63	0.65	0.61
	CKPTY	1	0.69	1	0.63
Jun'14	PKPTY	0.54	0.65	0.59	0.69

	CKPTY	1	0.69	1	0.73
Sep'14	PKPTY	0.48	0.67	0.57	0.66
	CKPTY	1	0.61	1	0.66

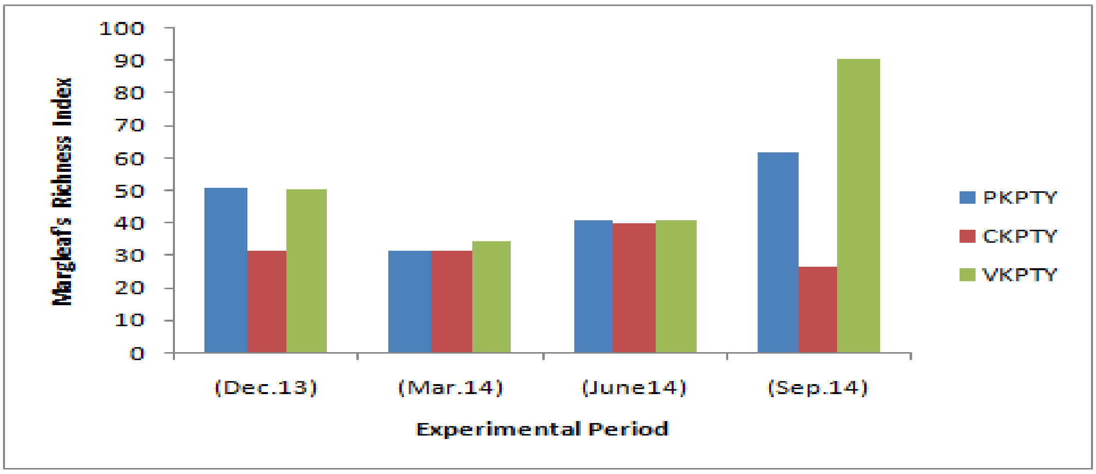

Figure 1: Margleaf's Richness Index analyzed on the desiccate pond surfaces, analyzed in the experimental ponds

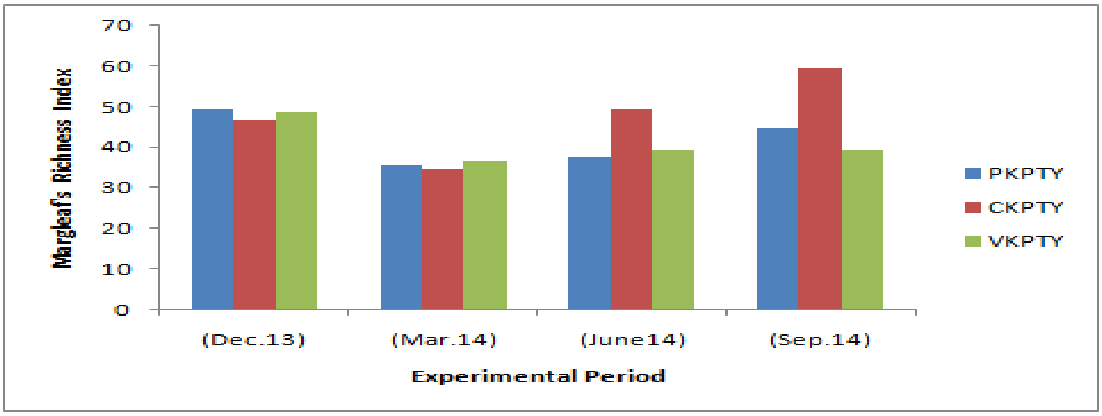

Figure 2: Margleaf's Richness Index analyzed at the shore line region of raised bund vegetation, of the experimental ponds

Conclusion

The survey on the phyto diversity of the temporary ponds further confirms the emphasis laid by King *et al.,* (1996) that the extreme conditions prevailing in the temporary or ephemeral ponds could be attributable to the alternating wet and dry conditions, which further lead to be a unique ecosystem to hold the variety of macrophyta diversity. A high degree of variation in the species occurrence was found in the present investigation could be attributable to the biotic interference, along with the prevailed natural conditions at the experimental site.

Acknowledgement

Financial assistance by the Ministry of Environment, Forests and Climate Change, Government of India, New Delhi, for the Grant sanctioned (MoEF/ERS(RE)/2009/14-43) to the research project is gratefully acknowledged.

References

Dé ath, G. 2002. Mutivariate regression trees, a new technique for modeling species- environment relationships, *Ecology*, 83: 1105-1117.

Juan, J. Gaitán, J., Oliva, G.E., Bran, D.E. <aestre, F.T., Aguiar, M.R., Jobbágy, E.G., Buono, Q.G., Ferrante, D.and Nakamatsu, V.B. 2014, Vegetation structure is as important as climate for explaining ecosystem function across Patagonian rangelands. *Journal of Ecology*, 102:1419-1428.

Gayet, G., Croce, N., Grillas, P., Descheamps, C. efos du Rau, P. 2012. Expected and unexpected effects of waterbirds at Mediterannean aquatic plants. *Aquatic Botany*, 103: 98-105.

Hicks, C., Woroniecki, S., Fancourt, M., Bieri, M., Robles, H.G., Trumper, K., Mant, R., 2014. *The relationship between biodiversity, carbon storage and the provision of other ecosystem services*: Critical review for the forestry component of the International Climate Fund.

Kannan, D. and Mahesh, M. 2016. *Grass vegetation dynamics of Vettangudi wildlife habitat ponds, southern India.* In: Proceedings, 10th IRC 'The Future Management of Grazing and Wildlife La ds in a High-Tech World", (Ed., Allan Iwasasa, et al., July, 17-22, Saskatoon, Canada, pp/ 462-463.

Khan, S.M., harper, D., Page, S. Ahmad, H., 2011. Species and Community Diversity of vascular flora along environmental gradient in Naran Valley: A multivariate Approach through indicator species Analysis, *Pak. J. Bot.,* 43: 2337-2346.

King, J.I., Simovich, M.A., and Brasca, R.C., 1996. Species richness endemism and ecology of crustacean assemblages in southern California vernal pools. *Hydrobiologia,* 328: 85-116.

Laflamme, J. Munson, A.D., Grondin, P. and Arseneault, D. 2016. Anthropogenic disturbance creates a new vegetation topospace in the Gatineau River Valley, Qubeck. *Forests,* 7: 10.3390/f7110254

Lukács, H.A., Sramko, G., and Molnar, V.A. 2013. Plant diversity and conservation value of continental temporary ponds. *Biological Conservation*, 158: 393-400.

Mac Arthur, R., and Wilson, E., 2007. *The theory of island biogeography*, Princeton University Press.

Mahesh, M. and Kannan, D. 2018. Interactive phenomenon of plants and avian diversity in Vettangudi birds sanctuary, Southern India. *Science International*, 6: 65-70. DOI: 10.17311/sciintl.2018.65.70.

Moneterro, A.T., Fava, F., Parolo, G., Speco, D., and Bocchi, S., 2013. Landscape context determinants to plant diversity in the permanent medows of southern European Alps. *Biodiversity Conservation*, 22: 937-958.

Nicolet, P. Biggs, J. Fox, G., Hodson, M.J. Reynolds, C., Whitefield, M. and Williams, P. 2004. The wetland plant and macroinvertebrate assemblages of temporary ponds in England and Wales. *Biological Conservation*, 120: 261-278.

Saini, D.C., Singh, S.K. and Rai, K. 2010. Biodiversity of aquatic and semi-aquatic plants of Chambel River in National Chambal Sanctuary, Madhya Pradesh. *Journal of Environmental Biology*, 29: 701-710.