ANALYSIS 3(10), April - June, 2017

ISSN 2394–8558 EISSN 2394–8566

Climate Change

Assessment of the bio-wealth, threats and impacts of climate change on Velli: a vanishing Lake of Trivandrum

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Publication History
Received: 27 March 2017
Accepted: 24 April 2017
Published: April-June 2017

Citation
Padma Mahanti, Sanjeet Kumar. Assessment of the bio-wealth, threats and impacts of climate change on Velli: a vanishing Lake of Trivandrum. *Climate Change*, 2017, 3(10), 771-780

ABSTRACT

Urban lakes play an important role to maintain the urban biodiversity. In Trivandrum, Kerala, India, there are a number of urban lakes. Among them, Velli lake is situated between 8° 31′ 39″ N, 76° 54′ 30″ E. It is rich with diverse bio wealth but at present is affected badly due to urbanization and other abiotic-biotic factors. A survey was carried out to document bio-wealth and to screen the visible threats. Results revealed that 68 major plant species were recorded along with 26 species of avifauna including one belonging to the RET (rare, endangered and threatened) category. The major visible threats were noted. The observations correlate the uncontrolled growth of *Eichhornia crassipes* with climate change in respect of temperature. The present study highlights the importance of urban lakes and recommends checking the threats for maintenance of a healthy urban ecosystem.

Keywords: Avifauna, Velli Lake, Bio-wealth, Threats, Lost of bio wealth, Urban Ecosystem

1. INTRODUCTION

Urban lakes are the cooling agents of the developing warm cities. The temperature is increasing very rapidly in the cities due to the loss of floral wealth and extensive pressure of anthropogenic activities (Sokolow et al, 2016). The increased temperature creates harmful impacts for human beings and the floral & faunal wealth. To fight against the temperature, the urban lakes play an important role. They reduce the temperature of nearby area and give the shelters to the faunal wealth. They are also rich with the aquatic, semi-aquatic and other floral wealth. They provide home of aquatic avifauna and migratory birds which reflects their importance in ecological balance. The floral wealth of lakes has economic, medicinal and socio-cultural values. The urban lakes are also the source of diverse regional wild species of fish which are the economic status of the fishing community resident near the lakes (Tockner and Stanford, 2002; Tranvik et al., 2009; Woodward et al., 2010; Ubeda et al., 2013). The life styles in the urban cities are hectic and need a peaceful place to reduce the day by day mental tension and depression. In this regard, urban lakes play a hostile role for urban mass. There are many beautiful and resident friendly urban cities in India. Trivandrum is one of them. It is the capital of Kerala state and popularly known as "Thiruvananthapuram". The city enjoys the charm of Padmanabhaswamy temple, beautiful beaches, Poovar backwater, Velli Lake etc (Prasannakumari and Gangadevi, 2012). Among these keys of the beauty of this city, Velli Lake represents a sound touristic destination as well as rich with bio wealth. It is the part of Akkulam-Velli Lake and home of various flora and fauna which play a key role in the ecological balance of the city. Keeping this in view, an attempt has been made to document bio wealth and major threats of biodiversity loss of Velli Lake.

2. MATERIALS AND METHODS

2.1. Study area

The study area is located in the North-East of the Trivandrum. It is spreaded in about 12 ha area and connected to the sea through an outlet called Pozhi. It is highly important for tourism and recreation as well as for fisheries.

2.2. Enumeration of Floral Wealth

Field survey was carried out from November 2016 to April 2017 to enumerate the aquatic, sand dune and other flora species.

2.3. Documentation and monthly counting of avifaunal species and visible threats

The survey was carried out in above said period. For the documentation and counting the avifauna, 9 AM to 5 PM was selected. During the survey, the visible threats were noted and compared monthly.

3. RESULTS & DISCUSSION

The survey revealed that the study area is rich with floral and faunal diversity. 68 plant species are recorded. Among them most of the plants belongs to tree followed by herb, shrub and climber. The most common tree species are *Acacia auriculiformis, Alstonia scholaris, Thespesia populenia* (Plate 1.3), *Cassia fistula, Cerbera odollum, Coccus nucifera, Calophyllum inophyllum, Pongamia pinnata etc.*; shrub species are *Calotropis gigantea, Lantana camara, Stachytarpheta jamaicensis* etc.; herbs are *Centella asiatica* (Plate 1.1), *Mimosa pudica, Sida acuta, Biophytum sensitivum, Boerhavia diffusa etc.; climbers are Canavalia rosea* (Plate 1.5), *Passiflora foetida* (Plate 1.2), , *Ipomoea biloba* (Plate 1.4) etc.; aquatic herbs are *Pistia stratiotes* (Plate 1.6), *Eichhornia crassipes, Hygroryza aristata, Lemna minor, Spirodela polyrhiza etc.* Details are listed in Table 1. It was also observed that among the floral wealth, herbs (26) were more than tree (21) followed by shrub (8) and Climber (7). The population of *Eichhornia crassipes* showed a prominent aquatic weed in the study area. It was observed that the study area enjoys the habitat of 26 avifaunal species including Indian darter that belongs to Near Threatened categories. The most common avifaunal species are Whiskered tern, Watercock, Rufous treepie, Little grebe, Gray heron, Common myna, Cattle egret, Barn swallow, Little cormorant (Plate 2.2), Pond heron, Purple heron (Plate 2.4), Brahminy kite (Plate 2.5), Indian darter (Plate 2.1), Common crow, Jungle myna, Common sandpiper, Pied kingfisher (Plate 2.6), Common moorhen (Plate 2.3) etc. Among the noted avifaunal wealth, 24 species were belong to least concern (LC) and one was belong to near threatened (NT) as per the IUCN (International Union for Conservation of Nature) 3.1. Details are listed in the Table 2. During the survey, the 10 major threats were noted (Table 3; Plate 3). It was observed that in about 150 days, *Eichhornia crassipes* covered most of the part of the study area (Plate 4). It has created diverse negative impacts on the Lake. It was observed that the population of Brahminy kite, Indian darter, Little cormorant, Egrets and Pond heron is reduced (Figure 1) and it was also observed that the population of Purple heron and Common moorhen has increased may be due to the spreading of *Eichhornia crassipes* on the lake surface. The major visible threats are listed in the Table 3 and showed in Plate 3 & 4. During the study, it was observed that lake is going to be covered by the *Eichhornia crassipes*. It indicates the uncontrolled growth of this weed in lake (Plate 4). Recently Shu et al.

(2014) reported that the growth of *Eichhornia crassipes* is directly proportional to the temperature and light intensity. The survey has started in the month of November 2016 till 12th April 2017. The secondary data of Government of Kerala on temperature showed that the months of February, March and April 2017 has highest temperature. This increased temperature may catalyze the growth of *Eichhornia crassipes* in the lake. It is also justified with the information collected from the engaged officials in the study area. It was also observed that the average temperature of the city during 2006 to 2015 was 32.2° C and in the year of 2016 and 2017 till 12th April is between about 33-34 ° C. the study showed that the growth of this weed is the result of climate change in respect of temperature. The above words are justified with the Plate 5. It was observed that the population of some avifaunal species are reduced may be due to climate change in respect to temperature and spreading of the *Eichhornia crassipes*. The maximum count of *Haliastur Indus* was 28 in November 2016 which noted only 10 in April 2017. Same reduction was noted in *Bubulcus ibis, Ardea alba, Ardea intermedia, Anhinga melanogaster, Chlidonias hybrid* and *Microcarbo niger* (Figure 1). Other faunal species like *Mozambique tilapia* (exotic), *Oreochromis mossambicus* (exotic), *Chanos chanos*, *Etroplus gariepinus* and *Funambulus palmarum* were observed.

Table 1

The floral wealth of study area

Botanical Name	Categories
Acacia auriculiformis	Tree
Acalypha indica	Herb
Ageratum conoyzoides	Herb
Alstonia scholaris	Tree
Alternanthera philoxeroides	Aquatic herb
Alternathera sessilis	Herb
Artocarpus heterophyllus	Tree
Azolla pinnata	Aquatic herb
Barringtonia racemosa	Tree
Biophytum sensitivum	Herb
Boerhaavia diffusa	Herb
Calophyllum inophyllum	Tree
Calotropis gigantea	Shrub
Canavalia rosea	Climber
Cassia fistula	Tree
Casuarina angustifolia	Tree
Cayratia trifolia	Climber
Centella asiatica	Herb
Cerbera odollam	Tree
Cissampelos pareira	Climber
Cleome viscosa	Herb
Coccinia grandis	Climber
Coccus nucifera	Tree
Crotalaria verrucosa	Herb
Croton bonplandianum	Herb
Eclipta alba	Herb
Eichhornia crassipes	Herb
Elephantopus scaber	Herb
Emilia sonchifolia	Herb
Evolvulus alsinoides	Prostrate

Ficus benghalensis	Tree
Grewia asiatica	Shrub
Hemidesmus indicus	Climber
Hygroryza aristata	Aquatic herb
Ipomoea biloba	Climber
Ixora pavetta	Tree
Justicia diffusa	Herb
Lagerstroemia floribunda	Tree
Lantana camara	Shrub
Lemna minor	Aquatic floating herb
Leucaena leucocephala	Tree
Ludwigia adscendens	Herb
Mimosa pudica	Herb
Mollugo pentaphylla	Herb
Morinda tinctoria	Tree
Nymphaea nouchali	Herb
Pandanus utilis	Shrub
Passiflora foetida	Climber
Peltophorum pterocarpum	Tree
Phyllanthus reticulates	Shrub
Pistia stratiotes	Herb
Pongamia pinnata	Tree
Samania saman	Tree
Scoparia dulcis	Herb
Sida acuta	Herb
Sida cordifolia	Herb
Sida rhombifolia	Herb
Spathodea campanulata	Tree
Spirodela polyrhiza	Floating aquatic herb
Stachytarpheta jamaicensis	Herb
Swietnia mahagoni	Tree
Synedrella nodiflora	Herb
Tacoma stans	Shrub
Terminalia catappa	Tree
Thespesia populnea	Tree
Triumfetta pentandra	Shrub
Wedelia chinensis	Herb
Ziziphus oenoplia	Shrub

Table 2
Avifaunal diversity in the study area

Common name	Scientific Name	Categories
Barn swallow	*Hirundo rustica*	LC
Black bittern	*Ixobrychus flavicollis*	LC
Black kite	*Milvus migrans*	LC

Brahminy Kite	*Haliastur indus*	LC
Cattle egret	*Bubulcus ibis*	LC
Common myna	*Acridotheres tristis*	LC
Common Crow	*Corvus splendens*	LC
Common Moorhen	*Gallinula chloropus*	LC
Common sandpiper	*Actitis hypoleucos*	LC
Gray heron	*Ardea cinerea*	LC
Great egret	*Ardea alba*	LC
Greater coucal	*Centropus sinensis*	LC
Indian Darter	*Anhinga melanogaster*	NT
Jungle Myna	*Acridotheres fuscus*	LC
Intermediate egret	*Ardea intermedia*	LC
Kentish plover	*Charadrius alexandrinus*	LC
Little cormorant	*Microcarbo niger*	LC
Little grebe	*Tachybaptus ruficollis*	LC
Pied kingfisher	*Ceryle rudis*	LC
Pond heron	*Ardeola grayii*	LC
Purple heron	*Ardea purpurea*	LC
Rufous treepie	*Dendrocitta vagabunda*	LC
Watercock	*Gallicrex cinerea*	LC
Western reef heron	*Egretta gularis*	LC
Whiskered tern	*Chlidonias hybrida*	LC
White breasted waterhen	*Amaurornis phoenicurus*	LC

Table 3

Major threats of study area

Factor(s)	**Source / Cause / Category**
Speed boat	Tourism
Plastic bottles	Non-degradable
Polythene bags	Non-degradable
Eichhornia crassipes	Biotic
Water pollution	Urbanization
Speed Boat of Vikram Sarabhai Space Centre	Governmental
Floating Restaurant	Tourism Department
Food Packets	Local shops
Coconut husk	Local shops
Invasive flora	Biotic

Plate 1

Floral diversity of the study area, *1: Centella asiatica, 2: Passiflora foetida, 3: Thespesia populnea, 4: Ipomoea biloba, 5: Canavalia rosea, 6: Pistia stratiotes*

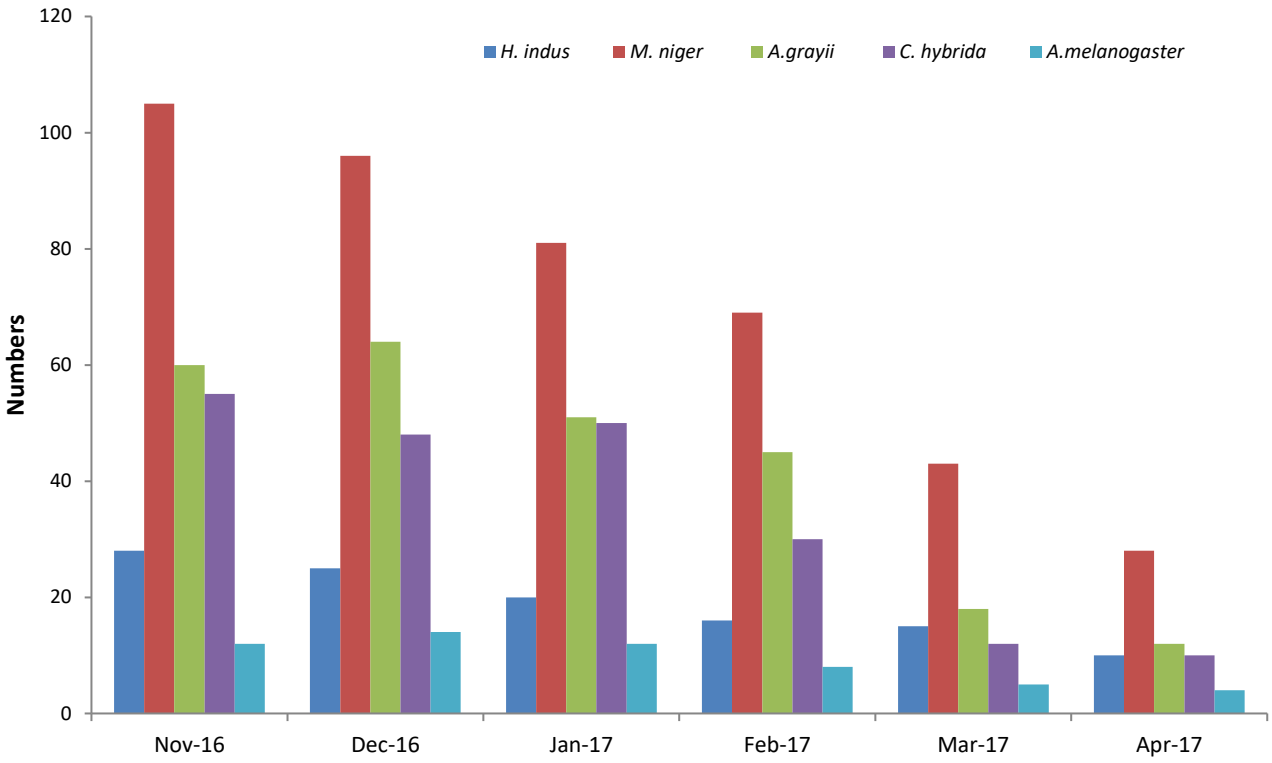

Figure 1
Comparative impact of threats on five major avifaunal species in 150 days

Plate 2
Avifaunal diversity of the study area, 1: Indian darter, 2: Little cormorant, 3: Common moorhen, 4: Purple heron, 5: Brahminy kite, 6: Pied kingfisher

Plate 3

Threats to the study area, 1: Plastic bottles and bags, 2: Coconut husk, 3: Speed boat, 4: *Eichhornia crassipes*

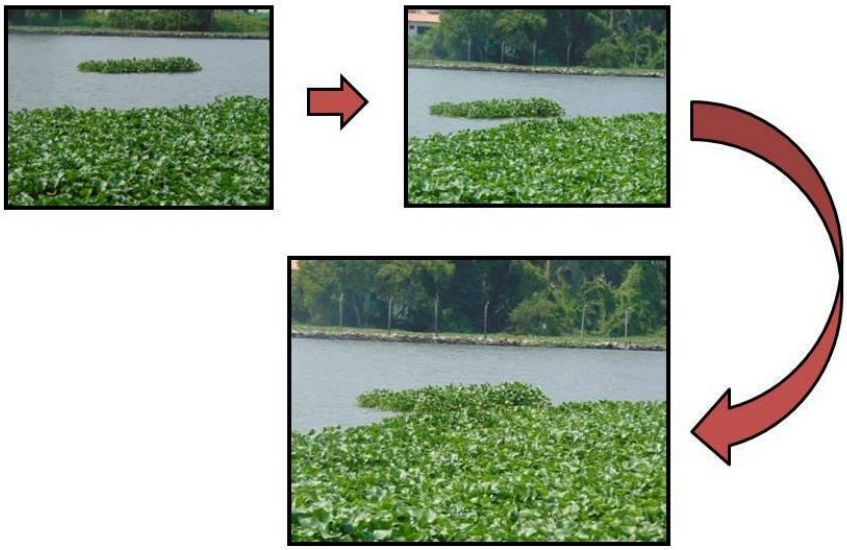

Plate 4

The process to cover the lake by *Eichhornia crassipes*

Plate 5
Changing the face of lake with *Eichhornia crassipes*

4. RECOMMENDATION

The present study suggests the following remedial measures for the sustainability of the Velli Lake:

1. Sustainable removal of *Eichhornia crassipes*.
2. Ban of Plastic bags, Plastic food packets and Plastic bottles.
3. Ban on speed boat and use the paddle boat.
4. During boating, a favorable distance from the habitat of avifauna.
5. Check all effluents and wastes.
6. Regular survey needed.
7. Trainings on sustainable management of the lake area should be provided to the employees of various sectors operating around the lake.
8. Signages and awareness materials to be displayed around the lake area & an interpretation centre should be established in the tourism dept. office wherein the ecological & conservation values of the lake need to be displayed.
9. Plastic management rules to be strictly enforced in the area.
10. Planting of native species along the lake side.

5. CONCLUSION

Velli is urban lake having rich floral and avifaunal diversity. It plays an important role in the ecological balance of the city Trivandrum. It is the home of a near threatened avifaunal species (Indian darter) along with diverse medicinal plants such as *Centella asiatica*. The study concluded that it is badly affected by the anthropogenic activities and spreading of *Eichhornia crassipes*. During the study, almost all parts of the lake are covered with this aquatic weed may be due to climate change in respect of temperature and pollution. Therefore, removal of this weed is urgent need.

REFERENCE

1. Shu X, Zhang Q, Wang W. Effects of temperature and light intensity on growth and physiology in purple root water hyacinth and common water hyacinth (*Eichhornia crassipes*). *Envi Scie Pollution Res Int*, 2014, 21(22), 12979-12988.
2. Sokolow S, Godwin H, Cole BL. Impacts of urban water conservation strategies on energy, greenhouse gas emissions, and health: Southern California as a case study. *American J Public Health*, 2016, 106(5), 941-948.

3. Ubeda B, Giacomo ASD, Neiff JJ, Loiselle SA, Poi ASG, Galvez JA, Casco S, Cozar A. Potential effects of climate change on the water level, flora and macro-fauna of a large neotropical wetland. *PLoS One*, 2013, 8(7), e67787.
4. Prasannakumari AA, Gangadevi T. Biochemical components of the selected Macroflora associated with the Neyyar, Thiruvananthapuram, Kerala, India. *Int J Environ Scie,* 2012, 2(4), 1998-2005.
5. Tockner K, Stanford JA. Riverine flood plains: Present state and future trends. *Environ Conserv*, 2002, 29, 308–330.
6. Tranvik LJ, Downing JA, Cotner JB, Loiselle SA, Striegl RG. Lakes and reservoirs as regulators of carbon cycling and climate. *Limnol Oceanogr*, 2009, 54, 2298–2314.
7. Woodward G, Perkins DM, Brown LE. Climate change and freshwater ecosystems: impacts across multiple levels of organization. *Philos Trans R Soc London*, 2010, 365, 2093–2106.