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Diversity and dominance of flora around wetlands in Lakkavalli Range of Bhadra Wildlife Sanctuary, Karnataka

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Abstract

The present communication is based upon a research work and the building a database for plants in the wetlands of Lakkavalli range of Bhadra Wildlife sanctuary. From these wetlands, about 133 species of plants have been identified of which herbs (27), shrubs (22) climbers (19) and trees (65).The objective of the work was to help wetland managers and ecologists by providing an account of the floral characteristics around wetland community.

Keywords: Bhadra Wildlife sanctuary, diversity, Lakkavalli range and Wetlands

INTRODUCTION

Forest constitutes a dynamic biological system with many organisms living together in perfect harmony with nature (Ellenberg, 1978). Biological diversity is a key issue of nature conservation and species diversity is one of important components of the biological diversity (Ito, 1997). Forest lands extend over a great number of ecosystems, harbouring a rich diversity of species and genes. Rio earth Summit held in 1992 emphasized the need to conserve the biodiversity of the globe in general and tropics in particular. The work of conservation must envisage wetlands since they cover about six percent of earth surface and are well known for high diversity in class, composition and four broad categories of functions viz., physical-hydrological, chemical, biological and socio-economic. Biodiversity assessment is often restricted ion the red listing of threatened species and clarification of their habitat demands in forest practices and forest management plans. However, good data and appropriate indicators are necessary to assist policy making and monitoring to understand the causes of changes in biodiversity and to better implement protection strategies (Puumalainen *et al.,* 2003). Wetlands are well-known to nurture a good number of angiosperms providing conditions intermediate between true-aquatic and terrestrial ones.

India has over 1.08.276 species of bacteria, fungi, plants and animals already identified and described (Khoshoo, 1994). Out of these, over 84% species constitute fungi (21.2%), flowering plants (13.9) and insects (49.3%) etc.

Based on the data of the species already described, India is tenth among the plant-rich countries of the world, fourth among the Asian countries (Khoshoo, 1994). Moreover, India is also one among the 12-mega biodiversity centers of the world by having over 47.000 plant species. Its diversity is unmatched due to the presence of 16 different agro-climatic zones, 10 vegetative zones and 15 biotic provinces.

Flora lying at the base of food chain drive to energy flow in an aquatic system Their composition in the community has an enormous implication on local biodiversity. They strongly influence the water chemistry acting as both nutritional sinks through uptake and as nutrient pumps. They also have the property to improve the water quality by capturing heavy metals and ions.

Tropical forests are famous for being the most species rich ecosystems on the earth. These forests, which over only 7 per cent of the earth's land surface harbors more than half of the world species, are under constant threat of human interference resulting in the disappearance of plant species at an estimated rate of 0.8 to 2 per cent per year all over the world. This situation has raised global concern over the different constraints causing this damage to the tropical diversity. Human disturbance in terms of habitat destruction, introduction of exotic species, exploitation and pollution are considered as the major causes for the decline in species level both in India and worldwide (UNEP, 2001).

The most striking feature of the earth is the existence of life and the most striking feature of life is its diversity, topography, soil, climate and geographical location of a region influence the vegetation diversity of forest ecosystem.

Numerical quantification of biological diversity and / or its elements can be of great value because that kind of evaluation is objective and enables a comparison of current biodiversity status to be made between similar ecosystems. During the last century, a great number of different methods quantifying species diversity were developed (Ludwig and Reynolds, 1988 ; Patil and Taillie, 1982 ; Merganic and Smelko, 2004).

However disturbance sometime is the major factor in structuring communities by determining the forest dynamics, diversity and species richness (Shell, 1999). But the detailed description and discussion on the plant diversity along disturbance gradient from dry tropical forest is lacking (Sagar *et al.,* 2003). In this view, a study has been carried out to know the influence of disturbance on the structure, composition, dominance, species richness and diversity of plants in wetlands of Lakkavalli range of Bhadra Wildlife Sanctuary (BWLS), Karnataka to reveal the diversity and the similarity existing

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among the plant species.

The objective of the present study is to describe the diversity, dominance, structure and composition of five wetlands in Lakkavalli range of Bhadra Wildlife Sanctuary (BWLS), Karnataka along a disturbance gradient and also to reveal the diversity and similarity existing among the plant species.

MATERIALS AND METHODS

Study Area

The study was carried out in Lakkavalli range of Bhadra Wildlife Sanctuary, consisting an area of 223.17 sq. kms (13°34' to 13°46'N latitude and 75°29' to 75°45'E longitude) in the Karnataka state of Southern India. The altitude varies from 650 mts-1875 mts above sea level with a general elevation of 1200-1500 mts. The sanctuary is located in the Malnad region of Karnataka about 50 kms to the east of western ghats. The temperature in the valley ranges from 9-35°C. The region receives an annual rainfall of 1600 to 2000 mm during the southwest monsoon between June and September. A distinct rainfall gradient result in a variation in vegetation type from semi evergreen forest and moist deciduous forest through dry deciduous forest shoals and grassland type forest was selected for this study during 2007-08.

Koramaguddakere lies in an altitude of 2302 feet (13°37'173" N and 75°39'95" S). Pickupkere lies in an altitude of 2413 feet (13°36'571" N and 75°39'307" S). Ramannanakere lies in (13°36'37" N and 75°37'56" E). Anegundikere lies in (13°34'846" N and 75°36'416" E). Mavinahalladakere (backwater) lies in (13°34'846" N and 75°36'416"E).

The study was conducted in five wetlands Lakkavalli range of Bhadra Wildlife sanctuary. Each forest type is named after the dominant tree species. The size and number of the samples were determined. Species composition for trees, shrubs and herbs was prepared after a thorough survey of different wetlands. Within each wetlands all the vegetation layers, i.e. trees, shrubs and herbs were analyzed for species richness and diversity. Herbs were analyzed during peak growing season, plants and flora were identified with the help of plant taxonomists.

Methodology

The best method to estimate the plant diversity in this type of habitat is Belt transects. Transects of the size 1000m X 5m, was laid in the adjacent forest cover of each wetlands. All plant species including trees, herbs and climbers which are present in the transect were identified to the species level and their number was counted

In all the five wetlands plant species present around were collected, identified and systematic enumeration was made with the available monographs relevant literatures and taxonomic revisions (Cambel, 1918; Mathew. 1983: Rath. 1999 and Dharamendra Singh, 1999).

Species similarity among the flora was computed using Sorenson's index (Wilson M.V. et al., 1984).

$I = 2J/A+B$.

Where I=similarity, J=Common species of both the series a and b. A=Total number of species in series a and B= Total number of species in series b.

RESULTS

A total of 133 species belongs to 56 families were identified during the study. Among the five study area Anegundikere wetland is more speciose (N=54) followed by Mavinahallakere and Ramananakere. Koramaguddakere and Pickupkere are less species compared to Anegundikere, however number of individuals is in case of Mavinahallakere (Back water) followed by Anegundikere and Ramannanakere (Table1). Among the pooled data a weed *Chrmolina oderata* is most dominant followed by *Tectona grandis*, *Anogessus latifolia*, etc (Table2)

Shonnon-Wiener diversity index have not shown significant difference among different samples, while Simpson's index showed that Koramaguddakere and Pickupkere are having less plant diversity compared to other three (Table3).

We computed Sorenson's index to compare the vegetation around the wetlands. It is resulted that Koramaguddakere and Pickupkere are significantly associated (>40%) with Ramannanakere. While all other associations are less than 40% (Table4).

The species with family of all the wetlands are been given in table 5.

Table 1: Mean species richness for all the vegetation layers in different wetlands

Sample	Mean Individuals	Variance	Standard Deviation	Standard Error	Total Individuals	Total Species
Mavinahallakere	3.314	34.749	5.895	0.498	464	51
Anegundikere	2.843	26.579	5.156	0.436	398	54
Ramannanakere	2.571	25.959	5.095	0.431	360	51
Koramaguddakere	1.607	15.147	3.892	0.329	225	31
Pickup kere	1.657	13.738	3.706	0.313	232	34

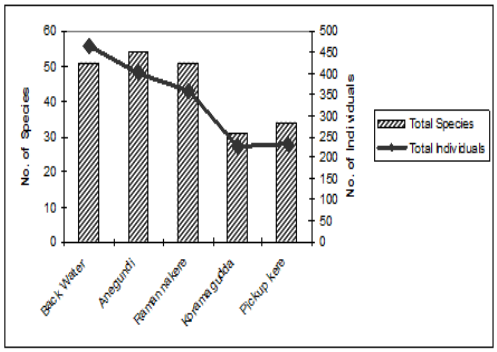

Table 2. Dominant plant species among pooled data

Species	Variance	Mean	Chi-sq
Chromolina oderata	101.4667	12.3333	41.1351
Tectona grandis	97.2	14	34.7143
Anogessus latifolia	84.7	5.5	77
Randia dumentorum	78.3	6.5	60.2308
Cinnamomum malabathrum	73.5	3.5	105
Sida rhomboideae	71.2	5	71.2
Cyclea peltata	70.6667	4.3333	81.5385
Asparagus racemosus	66.1667	5.1667	64.0323
Allophyllus cobbe	64.1667	5.1667	62.0968
Dalbergia latifolia	63.6	10	31.8
Mimosa pudica	61.6	9	34.2222
Cleome viscosa	60.9667	4.8333	63.069
Lagestroemia lanceolata	57.0667	8.3333	34.24
Macaranga peltata	49.5	4.5	55
Terminalia tomentosa	49.5	9.5	26.0526
Terminalia bellarica	47.3667	5.8333	40.6
Persea macrantha	46.3	3.5	66.1429
Cryptolepis buchanani	45.7667	5.1667	44.2903
Cassia fistula	42.5667	7.1667	29.6977

Table 3. Diversity components among different wetlands in Lakkavalli range of Bhadra Wildlife sanctuary

Wetlands	Simpsons Diversity (1/D)	Shannon H' Natural Log
Mavinahallakere	36.388	3.669
Anegundikere	35.683	3.693
Ramannanakere	30.963	3.556
Koramaguddakere	22.48	3.177
Pickupkere	25.99	3.312

Table 4. Sorenson's index and correlation of species between different wetlands

Sorenson's index	Mavinahalla kere	Anegundi kere	Ramannana kere	Koramagudda kere	Pickup kere
Mavinahallakere	1				
Anegundikere	0.21	1			
Ramannanakere	0.22	0.36	1		
Koramaguddakere	0.27	0.31	0.44*	1	
Pickup kere	0.31	0.25	0.45*	0.37	1

* significant.

DISCUSSION

From the study it is clear that this forest ecosystem supports good plant species and the varied with flora of this region faces severe constraints on conservation and the sanctuary has a long history of protection hence it retained wonderful diversity plants in it. The pace of development and the population pressure together with lack of knowledge on biodiversity are the major threats to the ecosystem conservation (Bentley, 1991). Diversity indices showed that Mavinahallakere and Anegundikere forests which are present in the core zone of the sanctuary are diverse in their vegetation than other three, which revealed that vegetation of the core are of the

sanctuary is more diverse than that of buffer area. Though major vegetation type of the study area is deciduous some of the evergreen species like *Persea macarantha* and *Hydnocarpus pentandra* were appeared in Ramannanakere forest which is present in core area. There is no special pattern observed in the association of species in between the different forest type studied.

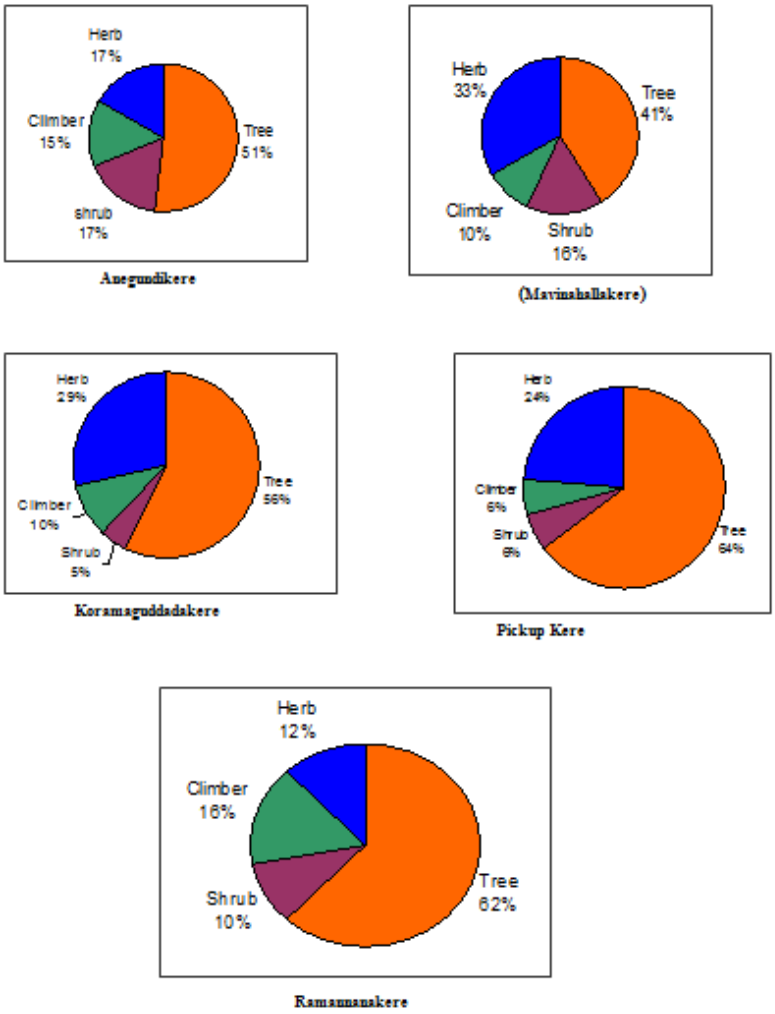

Fig. 2. Species richness in different wetlands

Table 5. Diversity of plant species among different wetlands in Lakkavalli range of Bhadra Wildlife Sanctuary.

Plant species	Family	Habit	Mavinahallakere	Anegundi kere	Ramannana kere	Korama Guddada kere	Pickup kere
Acacia concinna	Mimoseae	C		7			
Acacia instia	Mimoseae	T	4				
Ageratum conyzoides	Asteraceae	H	3			2	
Albizzia lebbeck	Mimoseae	T		5			
Albizzia procera	Mimoseae	T	1				
Allophyllus cobbe	Sapindaceae	S		16	15		
Alocasia sp.	Araceae	H					1
Alseodaphne semicarpifolia	Lauraceae	T			6		
Alstonia scholaris	Apocynaceae	T			1		
Anogessus latifolia	Combretaceae	T	22				
Antidesma ghaesemblia	Euphorbiaceae	T		3			
Ardesia solanaceae	Myrsinaceae	S		5			
Argeria nervosa	Convolvulaceae	C					2
Artocarpus lakoocha	Moraceae	T			2		1
Asparagus racemosus	Liliaceae	C			21	5	
Aspidopteris cordata	Malpighiaceae	C	1				

Bauhenia racemosa	Papilionaceae	T	2				
Bauhinia sp.	Caesalpiniaceae	T		2			
Bombax ceiba	Malvaceae	T		2		2	
Braynia retusa	Euphorbiaceae	S			5		
Butea monosperma	Papilionaceae	T		7			
Butea parviflora	Papilionaceae	C		8			
Caesalpinia mimosoides	Caesalpiniaceae	S		12			
Cansjera rheedii	Opiliaceae	S		5			
Carallia brachiata	Rhizoporaceae	T			4		
Careya arborea	Myrtaceae	T	5	11			8
Caseria tomentosa	Flacourtiaceae	S			1		
Cassia fistula	Caesalpinaceae	T	17	7	13	1	2
Cassia mimusoides	Caesalpinaceae	H	7				
Cassia sp.	Caesalpinaceae	S	4				
Cassia tora	Caesalpinaceae	H	8				
Centella asiatica	Umbelliferae	H		2			
Chromolina oderata	Asteraceae	H		22	4	20	22
Cinnamomum malabathrum	Lauraceae	T			21		
Cissus raphanda	Vitaceae	C			1		
Cleome viscosa	Capparaceae	H				18	11
Clerodendron viscosum	Verbinaceae	S		9	1	3	
Crotolaria sp.	Fabaceae	H	3	2			
Cryptolepis buchanani	Asclapiadaceae	C	6		18		5
Curculigo orchioides	Palmae	T	9		2		
Curcuma sp.	Zingiberaceae	H	5				
Cyclea peltata	Menispermaceae	C			21	5	
Cynodon dactylon	Graminae	H	2				
Dalbergia latifolia	Papilionaceae	T	18	15	12		
Dellinia pentagyna	Dilliniaceae	T			15	7	9
Dendrocalamus strictus	Graminae	T	15				3
Desmodium triquetrum	Papilionaceae	H		5	14		6
Dioscorea bulbifera	Dioscoriaceae	C		8	1		
Dioscorea pentaphylla	Dioscoriaceae	C		5			
Diospyros buxifolia	Ebenaceae	T					4
Diospyros montana	Ebenaceae	T	9				
Diploclisia glaucansis	Menispermaceae	C		5			
Drynaria quersifolia		H		2			
Elephantophus scaber	Asteraceae	H	12				
Embelia tsjerium -cottam	Myrsinaceae	C	15				
Emblica officinale	Euphorbiaceae	T	12	7		8	
Ficus callosa	Moraceae	T			9		5
Ficus hispida	Moraceae	T		2			
Ficus racemosa	Moraceae	T		8	4	2	
Ficus tsjehela	Moraceae	T		1			
Flacourtia indica	Flacourtiaceae	T	1				
Flemingia sp	Fabaceae	H	2				
Glochidion sp.	Euphorbiaceae	T					4
Grewia tilifolia	Teliaceae	T		11	1	8	13
Gynura nitida	Asteraceae	H					12
Helicteres isora	Sterculiaceae	S				5	5
Heliotropium indica	Boraginaceae	H	6			9	
Hippocratea sp.	Hippocrataceae	C		1			
Holarrhina antidysentrica	Apocynaceae	S	12				
Homonoia riparia	Euphorbiaceae	H		14			

Hopea ponga	Dipterocarpaceae	T				10	
Hydnocarpus pentadra	Flacourtiaceae	T			8		2
Ichinocarpus fruitiscence	Apocynaceae	C	3				
Ipomea sp.	Convolvulaceae	C	4				
Ixora coccinea	Rubiaceae	S				11	
Jasminum sp.	Oleaceae	C			3		
Kydia calycina	Malvaceae	T		2	2	2	
Lagestroemia flos-regini	Lythraceae	T		7			
Lagestroemia lanceolata	Lythraceae	T	20		1	12	6
Lannea coramandalica	Anacardiaceae	T			12		
Lantana camara	Verbinaceae	S					8
Leea talbotii	Leeaceae	S	15	1		3	
Macaranga peltata	Euphorbiaceae	T			19		12
Mallotus phillippinensis	Euphorbiaceae	T	5	3	4		9
Memecylon umbellatum	Melastomaceae	T				7	
Meyna laxiflora	Rubiaceae	T	8	12	2	2	4
Michelia champaca	Magnoliaceae	T			2		
Mimosa pudica	Mimoseae	H	20			13	9
Mitragyna parviflora	Rubiaceae	T	4		14		
Murraya koenegii	Rutaceae	T			2		
Musenda frondosa	Rubiaceae	C			2		
Narvelia zeylanica	Rananculaceae	C		1			
Nothopegia racemosa	Anacardiaceae	T		2			
Ochlandra rheedi	Graminae	S	2				
Olea dioca	Oleaceae	T			1		
Pavetta tomentosa	Rubiaceae	S		1			
Persea macrantha	Lauraceae	T			17		4
Polygonum glabrum	Polygonaceae	H		14			
Polygonum sp.	Polygonaceae	H					4
Pongamia pinnata	Papilionaceae	T		7			
Pterocarpus marsupium	Fabaceae	T		6			
Randia dumentorum	Rubiaceae	T	14	21	2		
Rauvolfia serpentina	Apocynaceae	H			1	2	
Rubus moluccanus	Rosacear	S	5				
Santalum album	Santalaceae	T				5	
Sapindus laurifolia	Sapindaceae	T		1			
Schlichera oleosa	Araliaceae	T	8	7			5
Securinuga leucopyurus	Euphorbiaceae	S	2				
Sida acuta	Malvaceae	H	5				
Sida rhomboideae	Malvaceae	H	21				8
Smilax zeylanica	Smalacaeae	C				1	
Solanum sp	Solanaceae	S	2				
Stachytarpeta indica	Verbinaceae	H	13				
Sterculia guttata	Sterculiaceae	T		6	8		
Strereospermum personatum	Bignoniaceae	T		4	7		7
Syzygium cumuni	Myrtaceae	T			7	8	
Taebernmontana heyniana	Apocynaceae	T			5		
Tamarindus indica	Fabaceae	T	2				
Tectona grandis	Verbinaceae	T	21	28		16	10
Terminalia bellarica	Combretaceae	T		8	16	11	
Terminalia paniculata	Combretaceae	T	21	18	15	13	13
Terminalia tomentosa	Combretaceae	T	18		2	12	14
Thespesia lampas	Malvaceae	T		2			
Trema orientalis	Urticaceae	T			5		2

Trewia nudiflora	Euphorbiaceae	T		5				
Triumfetta rhomboidea	Malvaceae	H		9				
Urena lobata	Malvaceae	S		9	4			
Ventilago maderaspatensis	Rhamnaceae	S	13					
Volvulopsis nummularia	Convolvulaceae	H	14					
Xanthium stromarium	Asteraceae	H	11					
Zanthoxylum rhetsa	Rutaceae	T			3			2
Zizyphus oenoplia	Rhamnaceae	S	12			2		
Zizyphus rugosa	Rhamnaceae	S		15	4			

C = Climber, T = Tree, H= Herb, S = Shrub.

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