FLORISTIC DIVERSITY ASSESSMENT ON THE AFFORESTED BANK OF MANASBAL LAKE, KASHMIR

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ABSTRACT

Floristic diversity study was carried out on the afforested bank of Manasbal Lake, Kashmir during the year 2009. The study was carried out in two vegetational strata's i.e. the tree and the herbaceous layer. The various phytosociological parameters like species richness, dominance and evenness index exhibited variations in both the strata in all the sites.

Key words: Floristic diversity, Manasbal Lake, Vegetational strata.

INTRODUCTION

The state of Jammu and Kashmir is very famous all over the world for its lofty mountains, fascinating valleys, water bodies and lush green forests.Among various water bodies present in Kashmir valley, Manasbal lake is one of them. It is located about 30 km north of Srinagar city and is considered as the supreme gem of all Kashmir lakes with lotus *(Nelumbo nucifera*) nowhere more abundant or beautiful than on the margins of the lake during July and August. It is the deepest lake of Kashmir valley and perhaps the only one that develops stable summer stratification. On the south of the lake is a hillock called 'Ahtung' which is used for limestone extraction. The eastern part is mainly mountainous and towards the north is an elevated plateau known as 'Karewa' The north-western bank of the lake was barren and was prone to soil erosion, then Faculty of Forestry, SKUAST-K in the year 1992 under took reclamation of the area under operational research project on Agroforestry funded by ministry of environment and forests and planted both coniferous and broad leaved tree species at the site. The afforestation programme was launched with the aim of preventing the soil erosion and heavy influx of nutrients into the lake which otherwise causes heavy growth of aquatic biomass in the lake causing trouble not only to the fish flora but also to navigation. Restoration of pristine glory of lake is of paramount importance in the tourist industry of Kashmir.

The floristic diversity which few years ago was considered unimportant by ecosystem ecologists has now been shown to be significantly important for many aspects of ecosystem functioning. The floristic diversity has been a source of amazement and scientific curiosity and increasingly a source of concern (Elourard *et al*., 1997). Floristic diversity is becoming a significant component as it is used and exploited variously for food, fodder, timber, medicines, recreation etc. More than 70,000 plant species are used in traditional and modern medicine. Maintaining healthy floristic diversity can play a vital role in climate change mitigation and the worlds protected areas-national parks, marine reserves, wilderness areas and so on are essential in safeguarding this role.

The sustainability of floristic diversity can be assessed only on the plant species there in (Gentry, 1992). Thus along with the understanding of floral diversity

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characteristics, the studies in relation to the other component i.e. in terms of their quantitative characters have become imperative for their proper management.

The present research therefore has been attempted on the afforested bank of Manasbal Lake to understand the floral diversity which is an important aspect of forest biology entailed the status and contribution of various species in structure and function of ecosystem.

MATERIALS AND METHODS

The study site lies between 70º-40' East longitude and 34º-15' North latitude at an elevation of 1583 meters above sea level and is about 30 km north of Srinagar city. The maximum temperature of the study site touches as high as 33º C in the month of July where as minimum temperature drops as low as –4ºC in the month of January. The annual precipitation of the area is about 700mm and most of the precipitation is received in the form of snow during winter months. The site was taken up for afforestation by the Faculty of Forestry, SKUAST-K in the year 1992. During afforestation fourteen tree species were planted in the area viz. *Acer negundo,Aesculus indica, Ailanthus altissima, Albizia Julibrissin, Catalpa bignonoides, Cedrus deodara, Cupressus torulosa, Celtis australis, Morus alba, Populus deltoides, Prunus armeniaca, Robinia pseudoacacia, salix alba and Ulmus wallichiana* (Anonymous, 1993). The area is about four kilometers in length where as its width ranges between fifty to hundred meters. The place is globally known for its beauty and is always figuring among the top tourist resorts of Kashmir valley. The research site was completely barren and was prone to soil erosion,then Faculty of Forestry took afforestation of the site and planted both coniferous and broad leaved species under a research project funded by ministry of environment and forests.The objectives of afforestation were to check the soil loss and heavy influx of nutrients into the lake which otherwise causes growth of aquatic weeds thus causing eutrophication.

The study was carried out during the year 2009. Four sites were selected for the present study. The size and number of quadrants were determined by species area curve (Ambasht, 1995).The quadrants were drawn in thorough consultation with statisticians and sampling was done in presence of the statistician. Total eight quadrants of size 10×10m for trees and eight quadrants of size 1×1m were randomly placed for the herbaceous layer. Frequency, diversity, dominance, IVI (importance value index), basal area and GBH (Girth at breast height) for both the layers were determined (Curtis, 1959). General diversity index (H), Species richness index (d_2) and Eveness index (e) were calculated after Shannon-Wiener (1963), Menhinick (1964), Pileou (1975) and Simpson (1949) respectively.

RESULTS AND DISCUSSION

Floristic diversity

Total 24 species belonging to 17 families were recorded. All these families show very less variation in terms of number of species. Certain families such as Sapindaceae,

Fabaceae, Salicaceae, Asteraceae and Poaceae were more dominant and the remaining were monospecific. (Table 1).

Table 1. Floristic diversity on the afforested bank of Manasbal Lake, Kashmir

S.No.	Species	Family
1.	*Acer negundo*	Sapindaceae
2.	*Aesculus indica*	Sapindaceae
3.	*Ailanthus altissima*	Samaroubaceae
4.	*Albizia julibrissin*	Fabaceae
5.	*Catalpa bignonioides*	Bignoniaceae
6.	*Celtis australis*	Cannabaceae
7.	*Cedrus deodara*	Pinaceae
8.	*Cupressus torulosa*	cupressaceae
9.	*Morus alba*	Moraceae
10.	*Populus deltoides*	Salicaceae
11.	*Prunus armeniaca*	Rosaceae
12.	*Robinia pseudoacacia*	Fabaceae
13.	*Salix alba*	Salicaceae
14.	*Ulmus wallichiana*	Ulmaceae
15.	*Tulipa stellata*	Liliaceae
16.	*Cynodon dactylon*	Poaceae
17.	*Stellaria media*	Caryophyllaceae
18.	*Taraxacum officinale*	Asteraceae
19.	*Poa bulbosa*	Poaceae
20.	*Salvia moorcroftiana*	Limiaceae
21.	*Euphorbia helioscopia*	Euphorbiaceae
22.	*Chenopodium album*	Chenopodiaceae
23.	*Conyza Canadensis*	Asteraceae
24.	*Trifolium pratense*	Fabaceae

Vegetational composition of tree and herbaceous layer

Tree Layer

Diversity values of woody species found in the area are presented in table 2.

Site I

In this site, only four species were recorded of which the highest density was recorded for *Robinia pseudoacacia* followed by *Ailanthus altissima* (6.0/m^2), *ulmus wallichiana* (3.75/m^2) and *Populus deltoides* (3.12/m^2) and IVI values for *Robinia*

pseudoacacia (72.06) was maximum followed by *Populus deltoides* (56.06), *Ailanthus altissima* (39.27) and *Ulmus wallichiana* (34.57).

Table 2. Plant diversity of the woody species

Details of Sites	General Diversity index (H)	Species Richness Index (d_2)	Index of Dominance	Evenness Index (e)
Site I	0.202	0.46	0.003	0.53
Site II	0.576	0.68	0.002	0.74
Site III	0.469	0.53	0.013	0.87

Site II

This site had nine tree species *Cupressus torulosa* exhibited maximum density (2.0/m^2) followed by *Prunus armeniaca* (1.25/m^2), *Salix alba* (1.12/m^2), *Aesculus indica* (1.0/m^2), *Catalpa bignonioides* (0.87/m^2), *Robinia pseudoacacia* (0.75/m^2), *Acer negundo* (0.62/m^2), *Celtis australis* (0.50/m^2) and *Morus alba* (0.25/m^2).

IVI values reflected that *Robinia pseudoacacia* (19.60) occupied first position followed by *Cupressus torulosa* (16.65), *Prunus armeniaca* (13.20), *Catalpa bignonioides* (8.89), *Aesculus indica* (8.36), *Salx alba* (6.80), *Celtis australis* (6.16), *Morus alba* (5.19) and *Acer negundo* (3.68).

Site III

On this site only five species were recorded. The highest density (4.75/m^2) was exhibited by *Albizia julibrissin* followed by *Morus alba* (3.57/m^2), *Populus deltoides* (3.25/m^2), *Ulmus wallichiana* (2.87/m^2) and *Robinia pseudoacacia* (2.25/m^2). The trend of IVI was *Robinia pseudoacacia* (7.40), *Albizia julibrissin* (7.25), *Morus alba* (6.21), *Populus deltoides* (4.08) and *Ulmus wallichiana* (3.97).

Site IV

This site had seven tree species. The highest density was recorded in *Robinia pseudoacacia* (12.25/m^2), followed by *Ulmus wallichiana* (10.75/m^2), *Aesculus indica* (9.12/m^2), *Ailanthus altissima* (8.87/m^2), *Cedrus deodara* (8.12/m^2), *Prunus armeniaca* (6.37/m^2) and *Celtis australis* (4.50/m^2). The IVI values were highest for *Robinia pseudoacacia* (20.29) followed by *Ailanthus altissima* (18.79), *Celtis australis* (13.02), *Prunus armeniaca* (10.22), *Ulmus wallichiana* (9.12), *Aesculus indica* (8.91) *and Cedrus deodara* (6.21).

Herbaceous layer

Diversity values of herbaceous species are presented in Table 3.

Table 3. Plant diversity of the herbaceous layer

Details of Sites	General Diversity index (H)	Species Richness Index (d_2)	Index of Dominance	Evenness Index (e)
Site I	0.402	0.32	0.0014	0.82
Site II	0.479	0.41	0.0020	0.73
Site III	0.512	0.32	0.0006	0.86
Site IV	0.501	0.28	0.00103	0.81

Site I

Herbaceous layer of this site had a very poor diversity. Only three species were recorded. The density of these species ranged from 5.09- 2.50. Highest IVI was recorded for *Cynodon dactylon* (10.95) followed by *Stellaria media* (9.14) and *Teraxacum officinale* (10.10).

Site II

Low variation was observed at this site also. Only four species were recorded and their density ranged from 0.62 – 12.05/m^2. The highest IVI was recorded for *Tulipa stellata* (25.40) followed by *Poa bulbosa* (24.13), *Salvia moorcroftiana* (15.80), *Euphorbia helioscopia* (15.09) and *Chenopodium album* (6.55).

Site III

Similar to the site II, this site also showed the presence of only five species. The highest density was found for *Conyza canadensis* (20.57/m^2) followed by *Trifolium pratense* (16.25/m^2), *Tulipa stellata* (13.59/m^2), *Cynodon dactylon* (10.37/m^2) and *Salvia moorcroftiana* (5.78/m^2). *Tulipa stellata* (26.40) had highest IVI followed by *Conyza canadensis* (24.17), *Trifolium pratense* (20.69), *Cynodon dactylon* (15.41) and lowest was for *Salvia moorcroftiana* (13.02).

Site IV

Poor diversity with the presence of only three species was seen at this site and their density ranged from 2.6- 14.25/m^2. The grass *Tulipa stellata* was dominant with (27.04) IVI followed by *Salvia moorcroftiana* and *Cynodon dactylon* with IVI (14.03) and (10.72) respectively.

Considering IVI as an indicator of dominance, *Robinia pseudoacacia* and *Tulipa stellata* dominated the woody species and herbaceous layer respectively in all the studied sites except for one site in herbaceous layer where the *Cynodon dactylon* exhibited a higher value. Generally the diversity index for the Indian forests ranged between 0.83 - 4.1 (Parsthasarathy *et al.,* 1992; Visalakshi, 1995). But in this area the species diversity values for the woody layer ranged between 0.202 – 0.576 (Table 2) and the species diversity value for the herbaceous layer ranged between 0.402-0.512 which are very low (Table 3). When compared to the Indian standard (Yadava and Supriya,

2006). This brings out to be an example of accelerating species extinction with reducing diversity affecting the forest ecosystem. The reason behind this decreased diversity may be human dominance as it has been proved by earlier workers that a high rate of anthropogenic activities result into reduction in diversity (Lindenmayer *etal;* 2008; Goparaju *et al.*, 2005).

Though many a times there occurs an increase in undergrowth species diversity due to such activities because planting of trees had made the conditions congenial for the invasion of local herbaceous species which are mostly shade loving.Verma etal;(2005) have also reported in their study that planting of trees encouraged the invasion of local species and therefore,diversity of herbs was found maximum under plantations. (Ram *et al.,* 2004) but man made disturbances usually leads to the forest degradation due to insufficient recovery time and also contribute to the disappearance of economically, ecologically or medicinally important plant species. As this area is situated on the bank of Manasbal lake and being an important tourist spot of Kashmir, it requires special protection and conservational measures which include complete fencing on the bank of the lake so as to protect the plantation against cattle and human interferences to create a more favorable environment for the establishment of the flora and facilitate to attract fauna. If conserved properly this afforested area will definitely act as a catalyst for successful natural forest succession. Conservation of such sites will also help in providing the basic needs of the locals and visitors of the area (Al- Amin *et al.,* 2007).

CONCLUSION

The present study thus concludes that there were fourteen species of trees and ten herbaceous species. Tree species planted on the bank of the Manasbal lake had modified the microclimate and thus new, sciophytic herbaceous species have grown under the cover of plantations. Thus specific ameliorative steps in terms of a proper protection from human interferences and scientific management of this area are imperative for making this a biodiversity rich site in Kashmir valley.

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