

Studies on Vegetation Analysis of The Afforested Bank of Manasbal Lake, Kashmir-India

Wani N. R.^{1*} and Mughal A. H.¹

¹Faculty of Forestry, Sher-e- Kashmir University of Agricultural Sciences and Technology of Kashmir, Shalimar, J&K - 191121 (India)

*Corresponding author. Email: nasirwani2002@yahoo.co.in

Abstract The study was carried out on the North-Western afforested bank of Manasbal Lake, Kashmir during the year 2009. Fourteen species of trees, five species of shrubs and twenty nine herbaceous species were recorded. *Robinia pseudoacacia* was found to be the dominant species in terms of density, frequency, abundance and IVI followed by *Ailanthus altissima*. Among shrubs *Rosa foetida*, was the abundant species while, *Cytisus scoparius* excelled in terms of density and frequency. *Tulipa stellata* was dense and frequent among all the herbaceous species but *Cynodon dactylon* was most abundant.

Key words

Afforestation, Manasbal Lake, Vegetation analysis

Vegetations are of immense importance in soil stabilization and erosion control especially in mountainous and hilly regions. They also protect and conserve water supplies and prevent floods. Small groups of trees and even single trees have a similar role locally in preventing washouts and in holding stream banks, they contribute significantly to nutrient recycling, carbon dioxide absorption, and oxygen generation. The vegetation analysis is very important in order to estimate the vegetation of the area. Through vegetation analysis, the given vegetation is classified for homogeneity of composition, stature etc. into different vegetation classes. Studies on changes in plant diversity and chemical properties of soil by Verma *et al.* (2004) under the plantations of *Cupressus torulosa* D. Don and *Robinia pseudoacacia* Linn. raised on mine over burden areas near Paonta Sahib in Sirmour district of Himachal Pradesh. The number of ground flora was recorded under *Cupressus torulosa* and *Robinia pseudoacacia* plantations were 30 m² and 42 m², respectively. Verma *et al.* (2005) carried out their studies on the Kuthar Forest range in Kunihar forest division of Himachal Pradesh and reported that the number of herbs and grasses species under plantation forest and degraded forest was 31 m² and 25 m², respectively. Singh (1998), while carrying out studies on the species composition, distribution pattern, diversity, concentration of dominance and community co-efficient found a difference in composition in tree, shrub and herbaceous species on north and south aspects.

Materials and Methods

The afforested bank of Manasbal Lake are located at 70°-40' East longitude and 34°-15' North latitude at an elevation of 1,583 meters above sea level and is about 30 km North of Srinagar city. The maximum temperature of the study site touches as high as 31°C in the month of July while as minimum temperature drops as low as -4°C in the month of January. The annual precipitation of the area is about 700 mm and most of the precipitation is received in the form of snow during winter months. The site is located on the North-Western bank of Manasbal Lake and was taken up for afforestation by the Faculty of Forestry, SKUAST-K in the year 1992 . During afforestation twelve tree species were planted in the area viz., *Acer negundo*, *Aesculus indica*, *Ailanthus altissima*, *Albizia julibrissin*, *Catalpa bignonioides*, *Cedrus deodara*, *Cupressus torulosa*, *Populus deltoides*, *Prunus armeniaca*, *Robinia pseudoacacia*, *Salix alba* and *Ulmus wallichiana*. In addition to this *Morus alba* and *Celtis australis* occurred naturally in the area due to dispersal of seeds. The area is about 1.6 km in length while as its width *ranges* between 40-50 meters. After survey of the entire area, quadrats of different sizes, 8 each for trees, shrubs and herbs were laid for vegetation analysis. The details of quadrats laid for vegetation analysis are as under:

Vegetation	Size of quadrat	Number of quadrats
Trees	10 x 10 m	8
Shrubs	5 x 5 m	8
Herbs	1 x 1 m	8

A base line was laid length wise through the centre of the whole area. Eight quadrats of size 10 x 10

m (Pande *et al.*, 2000) were laid on either side of the base line in a staggered fashion after every 200 m for vegetation analysis of trees. Similarly for shrub analysis, eight quadrats of size 5 x 5 m (Pande *et al.*, 1988) were laid within tree quadrat in a similar fashion as specified for tree analysis. Again, for analysis of herbs, 8 quadrats of size 1 x 1 m (Pande *et al.*, 2000) were laid within selected tree quadrat in a similar fashion as specified for tree and shrub analysis.

The assessment of species diversity was done by listing all the plant species (trees, shrubs and herbs) present within the quadrat of the study area and the identification of the species was confirmed by the experts. The vegetational data was quantitatively analysed for

density, frequency and abundance according to the formula given by Curtis and McIntosh (1950). The relative values of density, frequency and dominance were summed to get Importance Value Index (IVI) of individual species.

Results and Discussions

During the course of study fourteen species of trees, five species of shrubs and twenty nine herbaceous species were recorded from the quadrats on the afforested bank of Manasbal Lake. All the tree species except *Celtis australis* and *Morus alba* were planted during afforestation of the area (Anonymous, 1993). These two additional species have come up as a result of dispersal of seeds by birds or by small animals. The two species have also been reported to be the common associates of *Aesculus indica*, *Ulmus wallichiana* and *Robinia pseudoacacia* (Luna, 2005). Out of five species of shrubs, only *Cytisus scoparius* was planted and the other four species namely *Berberis pseudumbellata*, *Rosa foetida*, *Rosa webbiana* and *Rubus hoffmeisterianus* have come up in the area as a result of natural dispersal of seeds. Troup (1921) has reported that *Berberis pseudumbellata*, *Rosa foetida*, *Rosa webbiana* and *Rubus hoffmeisterianus* are the associated shrubs of *Aesculus indica*, *Celtis australis*, *Robinia pseudoacacia* and *Ulmus wallichiana* and the present study also confirms his statement. Twenty nine herbaceous species were recorded in different seasons on these banks because planting of trees had made the conditions congenial for the invasion of local herbaceous species, which are mostly shade loving. Verma *et al.* (2004, 2005) have also reported in their study that planting of trees encouraged the invasion of local species and therefore, diversity of shrubs and herbs was found maximum under plantations. Dar and Christensen (1999) also reported that vegetation types along the environmental gradient are largely factored by the topography, aspect, altitude, precipitation, light

and temperature and these factors profoundly determine composition and distribution of the vegetation.

Among trees *Robinia pseudoacacia* recorded maximum density (9.00/m²), frequency (100.00%), abundance (9.00) and IVI (72.06), while *Morus alba* registered minimum values for the same parameter except for frequency. High values of *Robinia pseudoacacia* could be attributed to abundant seed production and regeneration through root suckers as also reported by Luna (2005) and Prakash (1998). Low value of *Morus alba* is due to the fact that the species was not planted in the area but came up through natural dispersal of seeds. *Cupressus torulosa*, *Populus deltoides*, *Prunus armeniaca*, *Salix alba* and *Ulmus wallichiana* each recorded a frequency of (50%). An IVI of 56.06, 39.27 and 34.57 was recorded in *Populus deltoides*, *Ailanthus altissima* and *Ulmus wallichiana*, respectively. In a number of phytosociological studies higher IVI has been taken as indicator of dominance (Agni *et al.*, 2000; Pande, 2001 and Singh, 1998).

Cytisus scoparius was a dominant shrub in terms of density (0.87/m²) and frequency (75%). However in terms of abundance *Rosa foetida* recorded the maximum value of (2.50) followed by *Rosa webbiana* (1.50). Since *Cytisus scoparius* was a planted shrub, its density was more compared to other shrubs. *Berberis pseudumbellata* recorded the minimum density of (0.25/m²). Low density of shrub species is a result of dense canopy of trees which decreased light infiltration (Rikhari *et al.*, 1991). High frequency of *Cytisus scoparius* may be attributed to the abundant seed production and germination percentage. The results are in line with the findings of Verma *et al.* (2005). Pande *et al.* (2000, 2001).

Among the herbs density was recorded in the range of 0.37-12.25/m². The high density of *Tulipa stellata* could be attributed to its large sized propagules and high germinability, while low density of *Papaver moorcroftiana* could be due to small seed size. *Tulipa stellata* also excelled in terms of frequency (100%) whereas minimum frequency being recorded by *Lespedeza cuneata* and *Papaver moorcroftiana* (12.50%) each. These results are in conformity with the findings of Verma *et al.* (2004, 2005). In terms of abundance *Cynodon dactylon* topped the rank (20.37) followed by *Poa bulbosa* (13.78). Minimum abundance was recorded in *Coryza canadensis* (1.81). High abundance value of *Cynodon dactylon* could probably be due to natural vegetative propagation by runners. However low value of *Coryza Canadensis* could be attributed to seed damage due to high moisture content of the soil in the afforested area.

Table 1

Vegetation analysis of the afforested bank of Manasbal Lake, Kashmir

S.	Species	Density	Frequency	Abundance	Importance value
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No.		(m ²)	(%)		index (IVI)
Trees					
1.	<i>Acer negundo</i>	0.62	25	2.50	7.12
2.	<i>Aesculus indica</i>	1.00	25	4.00	8.36
3.	<i>Ailanthus altissima</i>	6.00	75	8.00	39.27
4.	<i>Albizia Julibrissin</i>	0.37	25	1.50	5.65
5.	<i>Catalpa bignonioides</i>	0.87	25	3.50	8.89
6.	<i>Celtis australis</i>	0.50	25	2.00	6.18
7.	<i>Cedrus deodara</i>	0.75	25	3.00	6.85
8.	<i>Cupressus torulosa</i>	2.00	50	4.00	16.65
9.	<i>Morus alba</i>	0.25	25	1.00	5.11
10.	<i>Populus deltoides</i>	3.12	50	6.25	56.06
11.	<i>Prunus armeniaca</i>	1.25	50	2.50	13.20
12.	<i>Robinia pseudoacacia</i>	9.00	100	9.00	72.06
13.	<i>Salix alba</i>	1.12	50	2.25	19.60
14.	<i>Ulmus wallichiana</i>	3.75	50	7.50	34.57
Shrubs					
1	<i>Berberis pseudoumbellata</i>	0.25	25	1.00	15.17
2	<i>Cytisus scoparius</i>	0.87	75	1.40	58.12
3	<i>Rosa foetida</i>	0.62	25	2.50	33.46
4	<i>Rosa webbiana</i>	0.37	25	1.50	24.57
5	<i>Rubus hoffmeisterianus</i>	0.50	50	1.33	20.29
Herbs					
1.	<i>Anemone biflora</i>	1.00	37.50	2.66	5.47
2.	<i>Cerastium vulgatum</i>	0.62	25.00	7.00	5.04
3.	<i>Chenopodium album</i>	0.74	18.75	4.75	6.55
4.	<i>Cirsium spp.</i>	1.37	37.50	3.66	7.62
5.	<i>Convolvulus arvensis</i>	1.78	34.37	5.79	10.00
6.	<i>Conyza canadensis</i>	1.71	37.50	1.81	10.16
7.	<i>Cynodon dactylon</i>	5.09	25.00	20.37	10.95
8.	<i>Daucus carota</i>	3.43	50.00	7.23	11.92
9.	<i>Erodium cicutarium</i>	1.90	43.75	4.41	10.38
10.	<i>Euphorbia helioscopia</i>	2.18	68.75	3.20	15.09
11.	<i>Galium aparine</i>	2.00	25.00	8.00	3.74
12.	<i>Lespedeza cuneata</i>	0.43	12.50	3.50	9.15
13.	<i>Lolium prene</i>	0.93	31.25	4.12	5.12
14.	<i>Medicago spp.</i>	1.00	25.00	4.00	6.07
15.	<i>Nepeta spp.</i>	1.00	31.25	3.50	7.38
16.	<i>Oxalis corniculata</i>	2.93	50.00	5.87	10.60
17.	<i>Papaver moorcroftiana</i>	0.37	12.50	3.00	2.03
18.	<i>Plantago lanceolata</i>	2.75	66.66	4.17	11.93
19.	<i>Poa bulbosa</i>	12.05	87.50	13.78	25.40
20.	<i>Potentilla reptans</i>	0.87	31.25	2.83	5.33
21.	<i>Salvia moorcroftiana</i>	3.87	75.00	5.15	15.80
22.	<i>Solanum nigrum</i>	2.56	68.75	3.75	11.65
23.	<i>Sonchus oleraceus</i>	1.00	50.00	2.00	11.00
24.	<i>Stellaria media</i>	3.25	25.00	13.00	9.14
25.	<i>Teraxacum officinale</i>	2.50	37.50	6.66	10.10
26.	<i>Trifolium pratense</i>	2.68	43.75	6.08	9.18
27.	<i>Tulipa stellata</i>	12.25	100.00	12.25	29.13
28.	<i>Verbascum thapsus</i>	0.62	25.00	2.50	6.54
29.	<i>Vicia sativa</i>	1.59	28.12	5.91	9.97

Conclusion

There were fourteen species of trees, five species of shrubs and twenty-nine herbaceous species. *Celtis australis* and *Morus alba* among trees, *Berberis*

pseudumbellata, *Rosa foetida*, *Rosa webbiana* and *Rubus hoffmeisterianus* among shrubs have invaded naturally in the area. Species planted on the bank of Manasbal Lake has modified the microclimate and thus new, sciophytic species of shrubs and herbs have grown under the cover. IVI was recorded maximum in trees, shrubs and herbs of *Robinia pseudoacacia*, *Cytisus scoparius* and *Tulipa stellata*, respectively.

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