

Regeneration Status of Herbs in different Seasons on the Afforested Bank of Manasbal Lake, Kashmir

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Abstract—The study was carried out on the North-Western afforested bank of Manasbal Lake, Kashmir during the year 2016 with the objective to study regeneration status of herbs in terms of density, frequency and abundance after every three months in different seasons (spring, summer, autumn and winter). After survey of the entire area, eight quadrats, each of size 1 x 1 m was laid out on either side of the base line in a staggered fashion after every 200 m for season wise analysis of herbs. The regeneration status of the herbaceous species revealed that only nine species were common in all the four seasons. However, they recorded maximum density, frequency and abundance in summer season. *Poa bulbosa* recorded maximum density in summer (12.62/m²), autumn (11.37/m²) and winter (9.62/m²), while *Tulipa stellata* recorded maximum density (12.25/m²) and frequency (100%) in spring season. Summer and autumn season belonged to *Poa bulbosa* for frequency i.e., 87.50 and 75.00 per cent, respectively, however, *Salvia moorcroftiana* was frequent enough in winter season (65.00%). Maximum abundance was recorded by *Cynodon dactylon* in all the four seasons i.e., 18.00, 25.50, 22.50 and 13.50 respectively.

Keywords: Herbs, Manasbal Lake, Regeneration status.

1. INTRODUCTION

Forests occupy a place of considerable importance in the economy of the J&K state and are more popularly known as green gold. They restore ecological balance of all ecosystems, maintain biological diversity, act as catchments for soil and water conservation and prevent floods also. The state of Jammu and Kashmir is very famous all over the world for its lofty mountains, fascinating valleys, lakes, streams and lush green forests. The state is located in the North-Western extremity of India between 32°-17' and 38°-58' North latitude and 73°-35' and 80°-36' East longitude with an average altitude of 1,586 metres from the mean sea level and annual precipitation of about 794.7 mm. From North to South, it extends over 640 kilometres in length and from East to West over 480 kilometres in breadth (Anonymous, 2000-01). The total geographical area of Jammu and Kashmir is 2,22,236 sq. km, which constitutes about 6.74 per cent of the total area of the country. The total forest area of Jammu and Kashmir is 25,064 sq. km (Anonymous, 2005). The regeneration status is carried out to study the regeneration of a particular area in terms of recruits, seedlings, saplings, etc. Regeneration is very

important for the perpetuation of the forests which are so essential for the existence of human life on the one hand and practice of scientific forestry on the other. Natural regeneration occurs on a forest site when young trees begin to grow there without having to be planted. Sometimes seeds have been dispersed in the area by wind, water or by birds. The regeneration survey is very important in scientific forestry and is generally carried out at the time of revision of working plans with a view to compare natural regeneration in any regenerating area at the end of the working plan with that of in the beginning to evaluate the effects of operations carried out during the working plan period and to prepare a stock map of an area proposed to be regenerated and to prescribe correct silvicultural treatment for various parts on the basis of the status of the regeneration in them as well as to serve as basis for comparison at the end of the plan. Regeneration in forest occurs in the form of recruits, seedlings, saplings and poles. Sapling and poles can be considered as established regeneration. The natural regeneration, obtained in the forest under the various systems is generally hidden under herbs and shrubs. Therefore, its ocular estimate is generally inaccurate. In the absence of 100 per cent enumeration, reasonably, accurate assessment of natural regeneration can be obtained by regeneration survey which is defined as "A survey for the assessment of established and unestablished regeneration, generally by sample enumeration" (Dwivedi, 1993). Total enumeration is not possible and therefore only 2 to 4 per cent enumeration is carried out. In mountainous area it is carried out by topographical units. In flat terrain it is done in strips. For this a base line is laid down and parallel survey lines of 100 m or 200 m are drawn at right angles to this. Regeneration survey is done in 2 x 2 m squares on both sides of the survey lines.

The study site for regeneration status is located at 34°-15' North latitude and 74°-40' East longitude at an elevation of 1,583 meters above sea level, and is about 30 km North of Srinagar city. The place is famous for lake (Manasbal Lake), which is one of the famous tourist resorts of our Kashmir valley. On the South of the lake is a hillock (Athung), which is used for lime stone quarrying. The Eastern part is mainly mountainous and mostly barren with sparse vegetation and

towards the North is an elevated plateau known as “Karewa”. The North-Western bank of the lake was barren and subjected to soil erosion, till in 1992 the Division of Forestry SKUAST-K, under Operational Research Project on Agro-forestry funded by Ministry of Environment and Forests (MOEF) under took reclamation of the area and planted 14000 plants of coniferous and broad leaved species at the site. At present, the tree species are well established and natural regeneration of the tree species has also started. Not only the natural regeneration but also some new species have invaded and established in the area (Anonymous, 1993).

2. MATERIALS AND METHODS

Study area

The afforested bank of Manasbal Lake is 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 banks of Manasbal Lake and was taken up for afforestation by the Division 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*. The area is about 1.6 km in length while as its width ranges between 40-50 meters. After survey of the entire area, 8 quadrats each of size 1 x 1 m for regeneration of herbs were laid out on either side of the baseline in a staggered fashion after every 200 m and analysis was carried out after every three months.

3. RESULTS AND DISCUSSION

The regeneration status (density/m², frequency% and abundance) of different herbs in different seasons on the afforested bank of Manasbal Lake, Kashmir was studied in four seasons (Table 1, 2 and 3).

Table 1: Regeneration status (density/m²) of different herbs in different seasons on the afforested bank of Manasbal Lake, Kashmir

S. No.	Species	Seasons			
		Spring	Summer	Autumn	Winter
1.	<i>Anemone biflora</i>	1.00	-	-	-
2.	<i>Cerastium vulgatum</i>	-	0.62	-	-
3.	<i>Chenopodium album</i>	-	-	0.87	0.62
4.	<i>Cirsium</i> spp.	-	-	1.37	-
5.	<i>Convolvulus arvensis</i>	1.25	2.62	1.75	1.00
6.	<i>Conyza canadensis</i>	1.00	1.75	1.62	0.52
7.	<i>Cynodon dactylon</i>	4.50	5.12	5.00	4.12
8.	<i>Daucus carota</i>	3.12	3.37	3.20	3.00
9.	<i>Erodium cicutarium</i>	1.87	2.12	2.00	1.75
10.	<i>Euphorbia helioscopia</i>	2.12	2.25	-	-
11.	<i>Galium aparine</i>	-	2.00	-	-
12.	<i>Lespedeza cuneata</i>	-	-	0.50	0.37
13.	<i>Lolium prene</i>	0.75	1.12	-	-
14.	<i>Medicago</i> spp.	1.00	-	-	-
15.	<i>Nepeta</i> spp.	-	-	1.25	0.75
16.	<i>Oxalis corniculata</i>	2.75	3.12	-	-
17.	<i>Papaver mocroftiana</i>	-	0.37	-	-
18.	<i>Plantago lanceolata</i>	2.75	3.00	2.87	-
19.	<i>Poa bulbosa</i>	10.62	12.62	11.37	9.62
20.	<i>Potentilla reptans</i>	-	-	1.00	0.75
21.	<i>Salvia mocroftiana</i>	3.37	4.75	4.37	3.00
22.	<i>Solanum nigrum</i>	-	-	2.62	2.50
23.	<i>Sonchus oleraceus</i>	-	1.00	-	-
24.	<i>Stellaria media</i>	3.25	-	-	-
25.	<i>Teraxacum officinale</i>	2.50	-	-	-
26.	<i>Trifolium pratense</i>	1.75	2.50	2.00	1.35
27.	<i>Tulipa stellata</i>	12.25	-	-	-
28.	<i>Verbascum thapsus</i>	-	0.62	-	-
29.	<i>Vicia sativa</i>	1.00	2.37	1.62	0.87

Table 2: Regeneration status (frequency %) of different herbs in different seasons on the afforested bank of Manasbal Lake, Kashmir

S. No.	Species	Seasons			
		Spring	Summer	Autumn	Winter
1.	<i>Anemone biflora</i>	37.50	-	-	-
2.	<i>Cerastium vulgatum</i>	-	25.00	-	-
3.	<i>Chenopodium album</i>	-	-	12.50	25.00
4.	<i>Cirsium spp.</i>	-	-	37.50	-
5.	<i>Convolvulus arvensis</i>	25.00	50.00	37.50	12.50
6.	<i>Conyza canadensis</i>	25.00	32.00	28.00	17.00
7.	<i>Cynodon dactylon</i>	25.00	75.00	62.50	12.50
8.	<i>Daucus carota</i>	37.50	50.00	42.50	30.50
9.	<i>Erodium cicutarium</i>	25.00	50.00	37.50	21.50
10.	<i>Euphorbia helioscopia</i>	62.50	75.00	-	-
11.	<i>Galium aparine</i>	-	25.00	-	-
12.	<i>Lespedeza cuneata</i>	-	-	25.00	12.50
13.	<i>Lolium prene</i>	12.50	50.00	-	-
14.	<i>Medicago spp.</i>	25.00	-	-	-
15.	<i>Nepeta spp.</i>	-	-	37.50	25.50
16.	<i>Oxalis corniculata</i>	50.00	62.50	-	-
17.	<i>Papaver moorcroftiana</i>	-	12.50	-	-
18.	<i>Plantago lanceolata</i>	62.50	75.00	70.00	-
19.	<i>Poa bulbosa</i>	50.00	87.50	75.00	25.00
20.	<i>Potentilla reptans</i>	-	-	37.50	25.00
21.	<i>Salvia moorcroftiana</i>	75.00	85.00	70.00	65.00
22.	<i>Solanum nigrum</i>	-	-	70.00	62.50
23.	<i>Sonchus oleraceus</i>	-	50.00	-	-
24.	<i>Stellaria media</i>	25.00	-	-	-
25.	<i>Teraxacum officinale</i>	37.50	-	-	-
26.	<i>Trifolium pratense</i>	25.00	50.60	37.50	12.50
27.	<i>Tulipa stellata</i>	100.00	-	-	-
28.	<i>Verbascum thapsus</i>	-	25.00	-	-
29.	<i>Vicia sativa</i>	25.00	35.00	30.00	19.50

Table 3 : Regeneration status (abundance) of different herbs in different seasons on the afforested bank of Manasbal Lake, Kashmir

S. No.	Species	Seasons			
		Spring	Summer	Autumn	Winter
1.	<i>Anemone biflora</i>	2.66	-	-	-
2.	<i>Cerastium vulgatum</i>	-	2.50	-	-
3.	<i>Chenopodium album</i>	-	-	7.00	2.50
4.	<i>Cirsium spp.</i>	-	-	3.66	-
5.	<i>Convolvulus arvensis</i>	5.00	10.50	8.66	3.00
6.	<i>Conyza canadensis</i>	2.00	7.00	4.00	1.25
7.	<i>Cynodon dactylon</i>	18.00	25.50	22.50	13.50
8.	<i>Daucus carota</i>	8.33	9.00	6.00	5.60
9.	<i>Erodium cicutarium</i>	10.75	14.25	12.00	4.66
10.	<i>Euphorbia helioscopia</i>	3.40	5.00	-	-
11.	<i>Galium aparine</i>	-	8.00	-	-
12.	<i>Lespedeza cuneata</i>	-	-	4.00	3.00
13.	<i>Lolium prene</i>	6.00	8.25	-	-
14.	<i>Medicago spp.</i>	4.00	-	-	-
15.	<i>Nepeta spp.</i>	-	-	5.00	2.00
16.	<i>Oxalis corniculata</i>	5.50	6.25	-	-
17.	<i>Papaver moorcroftiana</i>	-	3.00	-	-
18.	<i>Plantago lanceolata</i>	4.40	4.80	4.66	-
19.	<i>Poa bulbosa</i>	10.14	14.42	12.28	9.28
20.	<i>Potentilla reptans</i>	-	-	3.66	2.00
21.	<i>Salvia moorcroftiana</i>	4.00	5.00	4.50	3.30

22.	<i>Solanum nigrum</i>	-	-	3.50	2.00
23.	<i>Sonchus oleraceus</i>	-	2.00	-	-
24.	<i>Stellaria media</i>	13.00	-	-	-
25.	<i>Teraxacum officinale</i>	6.66	-	-	-
26.	<i>Trifolium pratense</i>	4.66	6.66	5.00	3.00
27.	<i>Tulipa stellata</i>	12.25	-	-	-
28.	<i>Verbascum thapsus</i>	-	2.50	-	-
29.	<i>Vicia sativa</i>	4.00	9.50	6.50	3.66

Spring season

A total of 18 herbs were recorded during spring season. The maximum density was recorded in *Tulipa stellata* (12.25/m²) followed by *Poa bulbosa* (10.62/m²), while as the minimum was recorded in *Lolium preenne* (0.75/m²). The maximum frequency was again registered in *Tulipa stellata* (100.00%) followed by *Salvia moorcroftiana* (75.00%), *Euphorbia helioscopia* and *Plantago lanceolata* each recorded a frequency of (62.50%), while as the minimum was recorded in *Lolium preenne* (12.50%). But the maximum abundance was recorded in *Cynodon dactylon* (18.00) followed by *Stellaria media* (13.00), *Tulipa stellata* (12.25), while as the minimum was registered in *Conyza canadensis* (2.00). High density and frequency of *Tulipa stellata* could be due to its large sized seeds and under high moisture conditions in the area, they get germinated easily with the result density and frequency is high. Low value of *Lolium preenne* is attributed to its small sized seeds and they get damaged under high moisture conditions with the result density is low. High abundance value of *Cynodon dactylon* could be attributed to its natural vegetative propagation by runners while as low value of *Conyza canadensis* could be attributed to restricted dispersal of seeds.

Summer season

Again 18 herbaceous species were recorded during the season. Maximum density was recorded in *Poa bulbosa* (12.62/m²) followed by *Cynodon dactylon* (5.12/m²), *Salvia moorcroftiana* (4.75/m²) while as the minimum was registered in *Papaver moorcroftiana* (0.37/m²). The maximum frequency was again registered in *Poa bulbosa* (87.50%) followed by *Salvia moorcroftiana* (85.00%), *Cynodon dactylon*, *Euphorbia helioscopia* and *Plantago lanceolata* each recorded a frequency of (75.00%) while as the minimum was recorded in *Papaver moorcroftiana* (12.50%). The maximum abundance was recorded in *Cynodon dactylon* (25.50) followed by *Poa bulbosa* (14.42) while as the minimum was recorded in *Sonchus oleraceus* (2.00). Since the seeds of *Poa bulbosa* are very big and they get germinated very easily under high moisture conditions, with the result density and frequency is high. Low density and frequency value of *Papaver moorcroftiana* could be due to its minute seeds. Since, *Cynodon dactylon* is a runner type, it gives roots where ever it passes, with the result its abundance is high. Low abundance value of *Sonchus oleraceus* is attributed to less dispersal of seeds.

Autumn season

Only 16 species were recorded in autumn season. The maximum density was again recorded in *Poa bulbosa* (11.37/m²) followed by *Cynodon dactylon* (5.00/m²), while as the minimum was recorded in *Lespedeza cuneata* (0.50/m²). The maximum frequency was registered in *Poa bulbosa* (75.00%) followed by *Plantago lanceolata*, *Salvia moorcroftiana* and *Solanum nigrum* each recorded a frequency of (70.00%) while as the minimum was registered in *Chenopodium album* (12.50%). The maximum abundance was recorded in *Cynodon dactylon* (22.50) followed by *Poa bulbosa* (12.28), *Erodium cicutarium* (12.00) while as the minimum was recorded in *Solanum nigrum* (3.50). High density and frequency of *Poa bulbosa* is attributed to its large sized propagules with the result these propagules germinate very easily under high moisture conditions. High abundance of *Cynodon dactylon* is attributed to its rapid vegetative propagation by runners.

Winter season

Only 14 species of herbs were recorded during winter season. The maximum density was recorded in *Poa bulbosa* (9.62/m²) followed by *Cynodon dactylon* (4.12/m²). *Daucus carota* and *Salvia moorcroftiana* each recorded a density (3.00/m²), while the minimum was recorded in *Lespedeza cuneata* (0.37/m²). The maximum frequency was registered in *Salvia moorcroftiana* (65.00%) followed by *Solanum nigrum* (62.50%), whereas the minimum was recorded in *Convolvulus arvensis*, *Cynodon dactylon*, *Lespedeza cuneata* and *Trifolium pratense* (12.50% each). The maximum abundance was recorded in *Cynodon dactylon* (13.50) followed by *Poa bulbosa* (9.28) and *Daucus carota* (5.60) whereas the minimum was recorded in *Conyza canadensis* (1.25). Only nine herbaceous species were common in all the four seasons. Herbaceous species, which were common in all the four seasons recorded maximum density, frequency and abundance in summer season.

4. CONCLUSION

- Among twenty nine herbaceous species, only nine species were recorded in all the four seasons at the study area.
- Nine herbaceous species common in all the four seasons recorded maximum density, frequency and abundance in summer season.

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- *Poa bulbosa* recorded maximum density in summer, autumn and winter season, while *Tulipa stellata* recorded maximum density and frequency in spring season.
 - Maximum abundance was recorded by *Cynodon dactylon* in all the four seasons.

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