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Vegetation analysis of shrub species along different altitudes of Benhama, Kashmir

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Abstract
The present study entitled "Vegetation analysis of shrub species along different altitudes of Benhama, Kashmir" was conducted at Faculty of forestry, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Benhama, Ganderbal, Kashmir during the year 2015-2016 with the aim to assess the floristic composition at this study site. Study site was divided three alitudes. Five quadrats of size 5m x 5m were laid for shrubs species per altitude. The floristic surveys conducted in the study area during the study period resulted in the identification of 9 shrub species belonging to 3 families. The phytosociology of the different elevations revealed that *Berberis lyceum* dominates all the three altitudes of the study site. The phytosociological attributes of shrubs species decreased along the altitudinal gradient.

Keywords: altitude, phytosociology, vegetation

Introduction
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 [6]. 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 [8]. Thus along with the understanding of floral diversity characteristics, the studies in relation to the other component i.e. in terms of their quantitative characters have become imperative for their proper management.

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.

The vegetation analysis is carried out to study the vegetation of a particular area in terms of species, its density, frequency, abundance, dominance and Importance Value Index. It is difficult to give information on floristic composition, stratification and other vegetational characteristics as it varies with season and year. It is also affected by biotic and abiotic components. It is the net result of their interaction which forms a type of community [11]. Analysis on the regional patterns of floristic richness showed that the main determining factors are those related to environmental heterogeneity (relief, substrates and climates). Plant species richness is also positively related to temperature and to water availability [10].

Materials and Methods
Location
The present investigation was conducted at Faculty campus of Faculty of Forestry located at

Benhama, Ganderbal, Jammu and Kashmir spread over 50 ha at an altitude of 1720m-1843m above mean sea level. The plantation site lies on the southern aspect at 34^0-16'N and 74^0-46' E longitude. The existing land of the study site composed of three types of land problems namely: degraded under utilized (scrub dominated), degraded pastures/grazing lands, barren rocky/stony wasteland. The study site falls in a mid to high altitude characterized by hot summers and very cold winters. The soil formation and soil deposits are essential pre-requisites for the growth and nature of plant life. The effect of climate, topography, parent rock material and time are important in soil formation and soil texture. The soil of the study site is sandy loam in texture; high in organic carbon with slightly neutral in pH and normal in electrical conductivity.

The present study on vegetation analysis was carried out by dividing the whole area of selected site (50 hactares) into three altitudes; Lower altitude: 1720 meters-1761 meters above mean sea level; Mid altitude: 1761 meters-1802 meters above mean sea level; Upper altitude: 1802 meters-1843 meters above mean sea level.

Sampling procedure

Sampling was carried out by stratified random sampling. Study site was divided into three altitudes and five (5) quadrats of size 5m × 5m were laid down per altitude for shrub species. The vegetation of selected site was recorded at all the quadrates laid at three altitudes. Vegetation data will be quantatively analyzed for the frequency, density, abundance and IVI according to procedures followed by Curtis and McIntosh (1950) [4].

Species diversity: Total no of species present at different altitudes

Density

Density number of individuals of a species that occurs within a given sample unit or study area. It was recorded as:

$$\text{Density} = \frac{\text{Number of individuals of the species}}{\text{Total number of quadrats studied}}$$

Frequency

Frequency is the number of times a plant species is present in a given number of sample units. It was calculated by the formula:

$$\text{Frequency (\%)} = \frac{\text{Number of quadrats in which the species occurred}}{\text{Total number of quadrats studied}} \times 100$$

Abundance

Abundance is a component of biodiversity and refers to how common or rare a species is relative to other species in a defined location or community. It was calculated by the formula:

$$\text{Abundance} = \frac{\text{Total number of individuals of a species in all quadrats}}{\text{Number of quadrats in which the species occurred}}$$

Importance value index

This index is used to determine the overall importance of each species in the community structure. The important value index (IVI) for each site was worked out by using formula given by Misra (1968) [9].

IVI = RF + RD + RA

Where,

$$\text{RF (relative frequency)} = \frac{\text{Frequency of individual species}}{\text{Frequency of all species}} \times 100$$

$$\text{RD (relative density)} = \frac{\text{Density of individual species}}{\text{Density of all species}} \times 100$$

$$\text{RD (relative dominance)} = \frac{\text{Basal area of individual species}}{\text{Total Basal area of all species}} \times 100$$

Results

The phytosociological parameters such as, species composition, density (D), per cent frequency (% F), abundance (A), importance value index (IVI), have been tabulated in Tables 1 to 4 for lower, middle and upper altitudes of Benhama, Ganderbal, Kashmir. The floristic diversity resulted in the identification of 9 shrubs belonging to 3 families at the study site. Out of the total families recorded, Rosaceae is the dominant family represented by five (5) species, followed by Fabaceae with three (3), and Berberidaceae with one (1). Out of the total genera recorded, the highest number of two species is respresented by two (2) genera viz. Rosa by (*R. moschata*, and *R. webbiana*) and Rubus by (*R. niveus* and *R. ulmifolius*), While as other five (5) generas are represented by a single species viz.*Amorpha fruticosa*, *Berberis lyceum*, *Cotoneaster nummalaris*, *Indigofera heterantha* and *Spartium junceum* (Table 01).

Table 1: Species composition at different altitudes (lower: 1720 m- 1761m amsl, middle: 1761 m- 1802m amsl, upper: 1802m-1843m amsl) in Benhama, Kashmir

S. No.	Species	Family	English/local name	Lower	Middle	Upper
1	*Amorpha fruticosa*	Fabaceae	False indigo bush	+	-	-
2	*Berberis lyceum*	Berberidaceae	Indian barberry	+	+	+
3	*Cotoneaster nummularis*	Rosaceae	Open fruit cotoneaster	+	+	+
4	*Indigofera heterantha*	Fabaceae	Himalayan Indigo/Zand	+	+	-
5	*Rosa moschata*	Rosaceae	MuskRose/Ban gulab	+	+	-
6	*Rosa webbiana*	Rosaceae	Wildrose/Bitcherphal	+	+	+
7	*Rubus niveus*	Rosaceae	Hill raspberry/Chanchh	+	-	-
8	*Rubus ulmifolius*	Rosaceae	Thorny blackberry/Chanchh	+	+	-
9	*Spartium junceum*	Fabaceae	Weavers broom	+	-	-

Floristic composition

The shrub species present at the study site ranged from three (3) to nine (9) at different elevation sites. The nine (9) number of shrub species were present at lower elevation followed by

six (6) species in middle elevation and three (3) species in upper altitude (Table 01). Among the shrub species, *Berberis lyceum*, *Cotoneaster nummularis*, *Rosawebbiana* were present at all the three elevations (Table 01).

At lower altitude, maximum density (1.67/m^2) and maximum frequency (66.67%) was shown by *Indigofera heterantha*. Highest abundance and highest IVI was reported in *Cotoneaster nummularis* (2.89/m^2) and *Berberis lyceum* (46.22) respectively. However, *Amorpha fruticosa* was having minimum values for density, frequency, abundance, and IVI with values of 0.73/m^2, 33.33%, 2.16/m^2, and 16.86 respectively (Table 02).

At middle altitude, *Berberis lyceum* was having highest density, frequency, abundance and IVI with values of 1.6/m^2, 60%, 3.38/m^2 and 60.07 respectively. Minimum values for density, and abundance was recorded by *Rosa webbiana* (0.66/m^2) and *Indigofera heterantha* (2.16/m^2) respectively. Minimum values for frequency and IVI was recorded in *Rosa moschata with* values 26.67% and 35.44 respectively (Table 03).

At upper altitude, highest density (1.2/ m^2), frequency (53.33%) and IVI (122.34) was shown by *Berberis lyceum* and highest abundance was shown by *Cotoneaster nummularis* (2.61/m^2). Minimum values for density was shown by *Cotoneaster nummularis* (1.0/m^2) and *Rosa webbiana* (1.0/m^2) and minimum values for frequency was observed in *Cotoneaster nummularis* (40%). Minimum values for abundance and IVI was shown by *Rosa webbiana* with values of 2.11/m^2 and 79.9 respectively (Table 04).

Table 2: Floristic composition and phytosociological attributes of shrub species at lower elevation (1720 m-1761m amsl)

S. No.	Species	Density (plants/m^2) (Mean ± S.E)	Frequency (%)	Abundance (plants/m^2) (Mean ± S.E)	IVI (Importance Value Index)
1	*Amorpha fruticosa*	0.73 ±0.17	33.33	2.16 ± 0.16	16.86
2	*Berberis lyceum*	1.46 ±0.24	53.33	2.72 ± 0.11	46.22
3	*Crotoneaste nummularis*	1.53 ±0.17	53.33	2.89 ± 0.11	40.0
4	*Indigofera heterantha*	1.67±0.24	66.67	2.52 ± 0.40	43.68
5	*Rosa moschata*	1.06±0.11	46.67	2.27 ±0.20	25.60
6	*Rosa webbiana*	1.20±0.11	53.33	2.27±0.14	28.22
7	*Rubus niveus*	1.46±0.06	46.67	3.27±0.49	37.64
8	*Rubus ulmifolius*	1.26 ±0.24	53.33	2.33 ± 0.19	36.14
9	*Spartium junceum*	1.06 ±0.13	46.67	2.33 ± 0.33	25.59
Total	11.65	453.33	23.13	300	

Table 3: Floristic composition and phytosociological attributes of shrub species at middle elevation (1761 m -1802m amsl)

S. No.	Species	Density (plants/m^2) (Mean ± S.E)	Frequency (%)	Abundance (plants/m^2) (Mean ± S.E)	IVI (Importance Value Index)
1	*Berberis lyceum*	1.6 ±0.30	60.0	3.38 ±0.2	60.07
2	*Crotoneaster nummularis*	1.4 ±0.32	46.67	3.00 ±0.28	47.63
3	*Indigofera heterantha*	1.0 ±0.11	46.67	2.167 ±0.16	45.24
4	*Rosa moschata*	1.53 ±0.13	26.67	2.5 ±0.28	35.44
5	*Rosa webbiana*	0.66±0.17	53.33	2.94±0.33	59.84
6	*Rubus ulmifolius*	1.26 ±0.35	46.67	2.78±0.22	51.77
Total	7.46	253.34	16.78	300	

Table 4: Floristic composition and phytosociological attributes of shrub species at upper elevation (1802m-1843 m amsl)

S. No.	Species	Density (plants/m^2) (Mean ± S.E)	Frequency (%)	Abundance (Plants/m^2) (Mean ± S.E)	IVI (Importance Value Index)
1	*Berberis lyceum*	1.2±0.2	53.33	2.22±0.11	122.34
2	*Crotoneaster nummularis*	1.0±0.23	40.0	2.61±0.2	97.74
3	*Rosa webbiana*	1 ±0.2	46.67	2.11 ±0.11	79.9
Total	3.2	140	6.94	300	

Discussion

Plant community at all the three altitudes was analysed for various parameters necessary to describe the vegetation at the study site. This spatial cum temporal analysis depicted a considerable change in the composition of plant species due to the grazing pressure, less protection and also loss of vegetation cover at the grazed site. Species composition is recorded to decrease with the increase in the altitude. Maximum number of species were found in lower altitude which begins to decline with the increase in altitude of the site. The highest species diversity in lower and middle altitudes might be due to moderate disturbance by grazing and invasion of new species. At upper altitude, the number of plant species declined overtime, mainly of palatable species due to the less nutrient content, selective grazing behaviour of livestock animal, thereby decreasing the ratio of palatable to non-palatable species. This variation might also be due to the soil type and its composition, elevation of sites, moisture contents of soil, nature of disturbance like grazing pressure, human interference and isolation of study site populated regions. Al Hassan *et al.* (2006) [1] in his study also reported similar factors responsible for the spatial variation in the vegetation. Connell (1978) [3] and Decocq *et al.* (2004) [5] also reported a highest diversity of species in intermediate disturbed ecosystem.

Due to grazing and trampling by cattle in upper altitudes, there is the reduction in the soil moisture as the compactness of the soil is increased. The highly compacted soil in general shows a lower permeability and increased runoff. Moreover denuded patches are created as a result of over-grazing by

domestic livestock, the direct sunlight received by soil surface at upper altitude enhances the chances of evaporation and finally results in reduction in the soil organic matter. Branson *et al.* (1981) [2] in his study on rangeland hydrology also reported reduction in soil moisture content due to grazing. Similarly Faizul *et al.* (1995) [7] in his study also concluded that the grazing decreases the percentage of organic carbon at upper and middle altitude which reduces soil organic matter, compacts the soil surface layer and ultimately increases surface runoff.

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