



## Original Research Article

# Life form classification and biological spectrum of Lamberi Forest Range, Rajouri, J&K, India

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## ABSTRACT

### Keywords

Biological spectrum, Floristic composition, Lamberi forest range, Life-form

The present paper deals with the different life form categories and biological spectrum of Lamberi forest range, Rajouri, J&K. A total of 222 species belonging to 80 families and 167 genera has been recorded from the area which was categorized in different life forms based on the position of their perennating bud. Therophytes (27.03%) and Macrophanerophytes (25.68%), were found to be dominant followed by Nanophanerophytes (14.41%), Chamaephytes (13.51%) and Hemicryptophytes (11.26%). Biological spectrum on life form was prepared and compared with Raunkiaer's normal biological spectrum as well as the spectra of the adjoining areas prepared by other workers. On comparison with Raunkiaer's normal spectrum area depicts Thero-phanerophytic type of phytoclimate.

## Introduction

A life form is characterized by plant adaptation to certain ecological conditions (Meera *et al.*, 1999) and is an important physiognomic attributes that have been widely used in vegetation studies. It indicates micro and macroclimate (Shimwell, 1971) as well as human disturbance of a particular area (Cain and Castro, 1959). Humboldt (1886) for the first time formulated the concept of the life forms for which he considered the location of perennating buds or organs. Raunkiaer (1934) used it as descriptive tool for classifying plant life forms based on the position and degree of protection of the renewing buds, which are responsible for the renewal of the plant's aerial body when the favorable season comes. According to this

system, plant species can be grouped into five main classes: Phanerophytes, Chamaephytes, Hemicryptophytes, Cryptophytes and Therophytes. The percentage of various life form classes put together is called as the biological spectrum. Raunkiaer (1934) constructed a "normal spectrum" which could act as a null model against which different life form spectra could be compared. Raunkiaer's normal spectrum indicates a phanerophytic community for the world and deviation from it determines the phytoclimate of the habitats. The occurrence of similar biological spectra in different regions indicates similar climatic conditions. Differences in the life form distribution between the normal spectrum and a

biological spectrum would point out which life form characterizes the phytoclimate or the vegetation under study.

When working with a species list, every species has the same weightage in the biological spectrum. This is called a floristic biological spectrum (Raunkiaer, 1934; Costa *et al.*, 2007). Generally a complete list of plants called floristic composition and their life-forms define the appearance of plant community. Since structure and rate of composition are sensitive indicators of whole environment, it is important to study the floristic composition and life-forms of different plants to find phytoclimate of the area. The biological spectra of different regions of J&K have been worked out by different researchers Sapru (1975), Kaul and Sarin (1976), Kapur (1982), Dhar and Koul (1986), Kumar (1987), Singh and Kachroo (1976), Kumar (1997), Kour (2001) Singh and Rawat (2000), Kesar (2002), Sharma (2003), Jhangir (2004), Dutt (2005) and Rai (2007). However the work on this aspect in the study area i.e. Forest Range Lamberi (Latitude 33<sup>0</sup> 06' to 33<sup>0</sup> 13' North and Longitude 74<sup>0</sup> 08' to 74<sup>0</sup> 18' East) located in inner Shiwalik region in Forest Division Nowshera has not been carried out so far. The present work has been carried out to study the assemblage of different life forms using floristic spectrum and to prepare the biological spectrum to infer the existing phytoclimate.

## Materials and Methods

The present study has been carried out in Lamberi forest range (Latitude 33<sup>0</sup> 06' to 33<sup>0</sup> 13' North and Longitude 74<sup>0</sup> 08' to 74<sup>0</sup> 18' East) which is a part of Nowshera forest division in Rajouri district of J&K. This forest range covers an altitudinal range of 600 m–1200 m a.s.l. and experiences great extreme of temperature with June recorded

as hottest and January coldest month with average maximum and minimum temperature of 37.4<sup>0</sup> C to 7.42<sup>0</sup> C. Average rainfall of area is 500 mm. Most of the rainfall occurs during monsoon season. Extensive field survey was conducted in the study area from June, 2011 to May 2012, in order to record the floristic composition and life form (on the basis of nature of perennating buds of plants species). All species were assigned a suitable life form according to Raunkiaer (1934) life form classification such as Therophytes (TH), Macrophanerophytes (MM), Nanophanerophytes (N), Chamaephytes (CH), Hemicryptophytes (H), Lianas (L), Geophytes (G), Hydrophyte (HH) and Epiphyte (E).

The percentage life form was calculated as follows

$$\% \text{ Life Form} = \frac{\text{Number of species in any life form}}{\text{Total number of species of all life forms}} \times 100$$

Biological spectrum was prepared for the study area and was compared with the Raunkiaer (1934) normal biological spectrum as well as the spectra of the adjoining areas prepared by other workers.

## Results and Discussion

The forests of the study area, extending from 900 m a.s.l. to 1200m a.s.l., represent subtropical vegetation and a transition zone where the angiosperm dominated subtropical forests are replaced by the gymnosperm dominated chirpine forests. The lower altitudinal belt is dominated by broad leaved trees with moderate scattered patches of shrubs while on moderate elevations, broad leaved trees are found to be mixed with shrubs and few chirpine communities. The higher elevations of the forest are dominated by *Pinus roxburghii* with few broadleaved species constituting second storey and

shrubs. As per the classification of Champion and Seth (1968) the forests of the study area have been represented by two types viz., broad leaved deciduous forests and Himalayan subtropical pine forests.

Dominant tree species present in the study area comprised of *Pinus roxburghii*, *Acacia modesta*, *Mallotus philippines*, *Dalbergia sissoo*, *Lannea coromandelica*, *Flacourtica indica*, *Zizyphus mauritiana*, *Melia azedarach*, *Toona ciliata*, *Cassia fistula* and *Grewia optiva*. The understory is prominently represented by *Carrisa opaca*, *Justica adhatoda*, *Zizyphus numularia*, *Gymnosporia royleana*, *Dodonaea viscosa*, *Woodfordia fruticosa*, *Mimosa rubicaulis*, *Solanum erianthum*, *Calotropis procera*, *Ricinus communis*, *Lantana camara*, *Ipomoea carnea*, etc. The herbaceous layer, structurally and numerically most prominent during monsoon season, is represented by *Cannabis sativa*, *Centella asiatica*, *Cassia tora*, *Euphorbia hirta*, *Tridax procumbens*, *Cyanodon dactylon*, *Malvestrum coromandelianum*, *Parthenium hysterophorus*, etc. while climbers have been represented by *Gloriosa superba*, *Ipomoea eriocarpa*, *Ipomoea muricata*, *Ipomoea purpurea*, *Bougainvillea spp*, *Cuscuta reflexa*, *Perugularia extensa*, *Hedera napalensis* and *Vicia sativa*.

Total number of species (222) recorded from study area (Sharma *et al.*, 2014) has been classified in different life form classes based on the Raunkiaer's system of classification. Number of species of different life form has been depicted in Table 1. The phytospectrum of the present study shows variation from the normal biological spectrum of Raunkiaer (1934) (Fig. 1). Perusal of the table revealed Therophytes (27.03%) to be the largest class followed by Macrophanerophytes (25.68%) and Nanophanerophytes (14.41%). Thus, the

biological spectrum of the research area shows "Thero-phanerophytic" phytoclimate. The comparison of the biological spectrum of the study area with Raunkiaer's normal biological spectrum is presented in Table 2. The higher percentage of therophyte (27.03%) occurring in the area is the characteristic of subtropics and often related to soil conditions and climate (Subramani *et al.*, 2007). The predominance of therophytes is attributed to various factors like prevalent microclimate of the region coupled with anthropogenic activities like grazing, looping, felling, deforestation, introduction of annual weeds, etc., as has also been advocated by other workers (Sharma, 2003; Sher and Khan, 2007; Khan *et al.*, 2011). Therophytes are followed by phanerophytes in order of dominance as the area falls in Shiwaliks which provides favourable edaphic and climatic conditions for the growth of over-storey.

Climatically, the study area in general is warm and dry during summer and warm and moist during rainy season, thus confirming the preponderance of therophytes (plants of warm and dry climate) and phanerophytes (of warm and moist climate). The comparison of life forms of study area with adjoining areas having similar climatic conditions in Northwestern Himalayas is represented in Table 3. Perusal of the table reveals that these regions show different type of phytoclimate despite being similar to one another. This may be because of the varied amount of disturbances and latitudinal and longitudinal difference in these areas. Among these areas, the phytoclimate of the study area resembles to that of Jammu (Sharma, 2003) and Mahamaya catchment (Sudan, 2007). Present study of forest range revealed that the vegetation is predominantly sub-tropical type having a higher percentage of therophytes and phanerophytes as compared

to normal biological spectrum. On the basis of this study the phytoclimate of the area, as per Raunkiaer's terminology, has been described as thermo-phanerophytic phytoclimate. This indicates influence of

anthropogenic activities (overgrazing and developmental activities) in the forest range which favors the chances of growth of short lived annuals.

**Table.1** Total number of species and percentage of different life form classes

Life form classes	No. of Species	Percentage(%)
Therophytes (TH)	60	27.03
Macrophanerophytes (M)	57	25.68
Nanophanerophytes(N)	32	14.41
Chamaephytes(CH)	30	13.51
Hemicryptophytes(H)	25	11.26
Lianas/Climbers(L)	9	4.05
Geophytes(G)	5	2.25
Hydrophytes(HH)	3	1.35
Epiphytes(E)	1	0.45
<b>Total</b>	<b>222</b>	<b>100</b>

**Table.2** Comparison of biological spectrum of study area with Raunkiaer's (1934) Normal Biological Spectrum

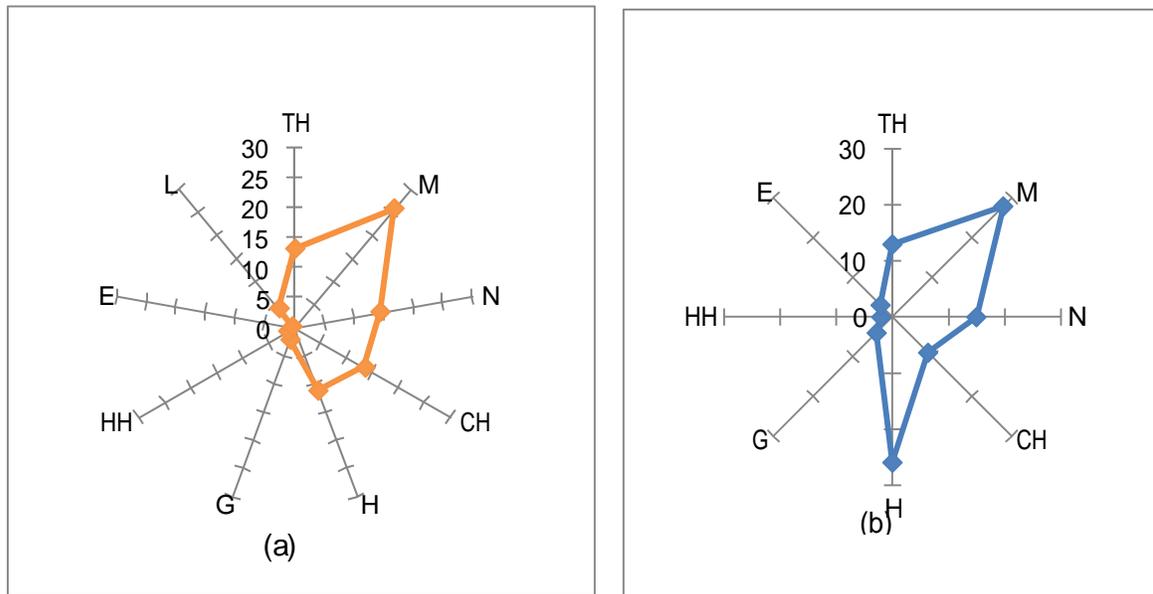
Life form	TH	M	N	CH	H	L	G	HH	E
Percentage life form (present study)	27.03	25.68	14.41	13.51	11.26	4.05	2.25	1.35	0.45
Percentage life form in normal spectrum	13.0	28.0	15.0	9.0	26.0	-	4.0	2.0	3.0
Percentage Deviation	+14.03	-2.32	-0.59	+4.51	-14.74	+4.05	-1.75	-0.65	-2.55

**Table.3** Comparison of life forms of study area with adjoining areas having similar climatic conditions in Northwestern Himalayas

Life form		TH	M	N	CH	H	L	G	HH	E
Study Area	Author	27.03	25.68	14.14	13.51	11.26	4.05	2.25	1.35	0.45
Kalakote Range	Singh, 2002	30.89	16.57	12.35	16.85	12.64	5.61	3.65	1.40	-
District Jammu	Sharma, 2003	35.45	16.70	11.64	13.93	9.11	8.87	2.02	1.78	0.50
Mahamaya Catchment	Sudan, 2007	38.45	19.50	10.99	13.82	7.44	7.08	1.06	1.06	0.70
Kishtwar	Raina and Kumar 2011	33.85	11.72	10.94	14.32	18.75	3.91	4.95	1.04	0.52

TH= Therophytes; M= Macrophanerophytes; N= Nanophanerophytes; CH= Chamaephytes; H= Hemicryptophytes; L= Lianas; G= Geophytes; HH= Hydrophytes; E= Epiphytes.

**Figure.1** (a) Biological spectrum of study area, (b) Raunkier's Normal Biological Spectrum



## References

- Cain, S.A., Castro, G.M.D. 1959. Manual of vegetation analysis. Harper and Brothers, New York.
- Champion, H.G., Seth, S.K. 1968. A revised survey of the forest types of India. Department of Forest, Govt. of India Publication.
- Costa, R.C., Soares, A.F., LimaVerde, L.W. 2007. Flora and life form spectrum in an area of deciduous thorn woodland (caatinga) in northeastern, Brazil. *J. Arid Environ.*, 68: 237–247.
- Dhar, U., Koul, A. 1986. Life form classification and biological spectrum of an alpine-subalpine flora of Kashmir Himalayas. The British Council, New Delhi. Pp. 3–20.
- Dutt, H. 2005. Ecological studies and conservation of medicinal plants of Neeru watershed, J&K. Ph.D Thesis. University of Jammu, Jammu, J&K, India.
- Humboldt, A. 1886. Ideen zu einer Physiognomik der Gewechra. Tubingeon.
- Jhangir, M. 2004. Phytodiversity Characterization of district Kathua using remote sensing and G.I.S. Ph.D. Thesis. University of Jammu, Jammu, J&K, India.
- Kapur, S.K. 1982. Phytosociological studies in Trikuta Hills with Special to the distribution pattern of economic plant products. Ph.D. Thesis. University of Jammu, Jammu, J&K, India.
- Kaul, V., Sarin, Y.K. 1976. Life form classification and biological spectrum of flora of Bhaderwah. *Trop. Ecol.*, 17(2): 132–138.
- Kesar, R.K. 2002. Phytosociological and community studies of Patnitop forests and their management. Ph.D. Thesis. University of Jammu, Jammu, J&K, India.
- Khan, N., Ahmed, M., Syed, S.S., Wahab, M., Siddiqui, M. F. 2011. Structure, diversity, and regeneration potential of *Monothecha buxifolia* (Falc.) A. DC. dominated forests of Lower Dir District, Pakistan. *Front. Agric. China*, 5(1): 106–121.

- Kour, I. 2001. Phytodiversity and impact of tourism on the vegetation of Trikuta Hills. (J&K). Ph.D. Thesis. University of Jammu, Jammu, J&K, India.
- Kumar, A. 1987. Phytosociological and productivity studies of Bhaderwah forests, Jammu (J&K). Ph.D Thesis. University of Jammu, Jammu, J&K, India.
- Kumar, K. 1997. Studies on plant diversity of Patnitop and adjoining area and impact of biotic activities. Ph.D. Thesis. University of Jammu, Jammu, J&K, India..
- Meera, A.G., Hagen, M.A., Orellana, J.A.V. 1999. Aerophyte, a new life form in Raunkiaer's classification. *Vegetation J. Sci.*, 10: 65–68.
- Rai, A. 2007. Studies on phanerogam diversity of Mansar-Surinsar wild-life sanctuary, J&K. Ph.D. Thesis. University of Jammu, Jammu, J&K, India.
- Raina, A.K., Kumar, R. 2011. Floristic composition, life form classification and biological spectrum of the Biological spectrum of the catchment of Rattle H.E. project, District Kishtwar- J&K. *Environ. Conserv. J.*, 12(3): 1–6.
- Raunkiaer, C. 1934. The life forms of plants and statistical plant geography. Clarendon Press, Oxford.
- Sapru, B.L. 1975. Vegetational studies in Jhelum valley. *Botanique*, VI (2&3): 151–164.
- Sharma, J., Raina, A.K., Sharma, S. 2014. Phytodiversity (Angiosperms and Gymnosperms and Pteridophytes) in Lamberi Forest Range, Rajouri, J&K, India. *Environ. Conserv. J.*, 15(1&2): 35–47.
- Sharma, N. 2003. Biodiversity characterization at landscape level using RS and GIS in District, Jammu. Ph.D. Thesis, University of Jammu, Jammu, J&K, India.
- Sher, Z., Khan, Z.D. 2007. Floristic composition, life form and leaf spectra of the vegetation of Chagharzi valley, District Buner. *Pak J. Plant Sci.*, 13(1): 57–66.
- Shimwell, D.W. 1971. The description and classification of vegetation. Sedgwick and Jackson, London. 322 Pp.
- Singh, G., Kachroo, P. 1976. Microclimate variations in Dachigam Sanctuary. *Indian Forestry*, 102: 838–849
- Singh, J. 2002. Phyto-diversity of Kalakote Range (Rajouri, J&K) and impact of mining and nomadism on the vegetation. Ph.D. Thesis. University of Jammu, Jammu, J&K, India.
- Singh, S.K., Rawat, G.S. 2000. Flora of great Himalayan National Park, Himachal Pradesh. Bishen Singh Mahendra Pal Singh, Dehradun 304 Pp.
- Subramani, S.P., Jishtu, V., Verma, R.K., Kapoor, K.S. 2007. Floristic composition, life forms and biological spectrum of Renuka Wildlife Sanctuary, Himachal Pradesh. *Indian Forester*, 133: 79–92.
- Sudan, J. 2007. Phytodiversity and socio-economic studies of Mahamaya Catchment, Jammu, J&K. Ph.D. Thesis. University of Jammu, Jammu, J&K, India.