

Composition and stratification of Pine forests of Himalayan Region of North Kashmir

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Abstract

Composition and stratification was examined in Gulmarg area of north Himalayan region of Kashmir division, north India. A total of 848 vascular plants were recorded from the all forest stands randomly, showed dominance of silver fir (*Abies pindrow*) (44-51%) in the community followed by *Taxus wallichiana* (11-17%), *Picea smithiana* (11-16%), *Pinus wallichiana* (7-16%). The presence of different life forms resulted into a four-layered distribution of plant species in the community. Out of the four layers, the woody species were distributed in two distinct layers, i.e., canopy, and understory layer which was followed by shrub and herb layers in the community.

Key words : Stratification, Pine forests, North Kashmir, Plant Diversity, Simpson's index.

The natural vegetation of Gulmarg forests is often mistaken for the pine forests. In fact the vanishing pristine forests of Gulmarg are now mostly confined to Biosphere Reserve, Wild Life Sanctuaries, and National parks. Besides acting as a gene pool and providing refuge to a large number of endemic, endangered and threatened species^{4,5} they change ecological services such as source of perennial water, maintain local micro environmental conditions and help in biogeochemical cycles¹³. Several quantitative measures are employed to describe the structure of plant communities with much ecological precision, qualitative characters such as species richness; life-form spectrum and vertical disposition of species

are some of the important parameters to describe community structure. Raunkiaer⁸ demonstrated communities of different climatic zones or phytoclimatic zones of the earth on the basis of life-form spectrum or Biological spectrum⁸. Any change in the life-form composition away from its phytoclimatic zone is regarded as an indicator of alteration in vegetation either due to biotic or abiotic factors or both. However, in recent years man has abused the natural vegetation so much so that often plant communities do not exhibit their natural structural complexities. Excessive utilization of forest resources and overgrazing has resulted in change in the existence of plant communities^{9,14}. Vegetation profile of the

component species indicates the phytoclimatic condition of the area and is employed commonly in community structural description^{1,2,7,10,12,15}. In the present paper structural composition and stratification in Gulmarg forests have been analyzed.

Study area :

Gulmarg lies in a cup-shaped valley in the Pir Panjal Range of the Himalayas, at an altitude of 2,650m (8,694 ft), 56km from Srinagar. The soil in Gulmarg comprises glacial deposits, lacustrine deposits and moraines of Pleistocene age covering shale, limestone, sandstones, schist and other varieties of rocks. The natural meadows of Gulmarg, which are covered with snow in winter, allow the growth of wild flowers such as daisies, forget-me-nots and buttercups during spring and summer. The meadows are interspersed by enclosed parks and small lakes, and surrounded by forests of green pine and fir. Skiing and other winter sports in Gulmarg are carried out on the slopes of Apharwat peak at a height of 4,267 m (13,999 ft). Many points on Apharwat peak and Khilanmarg offer a panoramic view of Nanga Parbat and Harmukh mountains. Owing to its high elevation, Gulmarg has a humid continental climate where the wet winter season sees heavy snowfall, especially for its latitude. Summers are moderate in temperature and length, whereas shoulder seasons are cool.

We selected total of 60 sites randomly for both low and high elevations and divided into 60 quadrates randomly for both elevations (total 60 quadrates). To analyze both the elevation, all individual plants ≥ 5 cm dbh were measured and tree height was measured with

the help of yardstick in order to specify the forests into strata. For both the chosen provinces, all species present were identified by approaching the plant taxonomist.

Data were also used for computation of analytical features such as density, relative density, frequency, relative frequency, area, relative area and IVI (importance value index) of important pine species given by Curtis & McIntosh (1950). IVI for the species was investigated as the sum of the relative density, relative frequency and relative area³.

Plant diversity was investigated by following Simpson's index¹¹:

$$D_s = \frac{\sum n_i(n_i - 1)}{N(N - 1)}$$

D_s = index of diversity

n_i = Number of i th species

N = Number of all individuals.

The forest was observed into canopy, understory, shrub and herb strata (layers). Canopy layer was seen having *Abies pindrow* dominance, understory with young *Abies pindrow* and mostly *Pinus wallichiana*. Shrub layer was covered with shrubs and saplings of pine and herb strata with huge number of herbs. A total of 848 vascular plants were recorded from both the elevations of all 60 quadrates. In all the stands *Abies pindrow* were dominant life forms in canopy and understory layers at both the elevations. Highest IVI was found for *Abies pindrow* for the whole forest stand and low for *Pinus wallichiana*. At low elevation Species density was recorded greater for *Abies pindrow*

compared to high elevation. Total density was recorded 13.75 at low elevation and 13.06 at high elevation for all pine species. Tree diversity was high (0.95), shrub diversity (0.97) and herb diversity (0.99) at high elevation. Tree diversity was 0.07, for shrubs 0.21 and for herbs 0.06 at low elevation. We found that both forest stands were made up of four forest strata viz; canopy, understory, shrub and herb layers. 15 species of herb layer belonging to 12 families which has also been recorded are shown in the appendix.

Anthropogenic exercises lead to Forest Island and manmade disruptions also alter tree species diversity³. Gulmarg forest region shows different disruptions which effect the

composition of plants at both the elevations. The study area was found to have four vertical strata which are as; canopy, understory, shrub and herb layers. Canopy was apparent with *Abies pindrow*, understory with young *Abies pindrow* and *Picea smithiana*, shrub layer with shrubs and seedlings of *Picea smithiana* where *Abies pindrow* density was low. Herb layer density was found high in places where *Abies pindrow* density was low compared to *Picea smithiana* in understory strata, whereas it was low in dense canopy layer. Sapling and seedling density of all pine species found high were all tall plant species density was low. Our study clearly revealed that apart from anthropogenic activities density and strata also impacts the plant population to a great extent⁶.

Appendix

S./No.	Taxon name	Local name	Family
1	<i>Arnebia benthamii</i>	Kehzaban	Boraginaceae
2	<i>Abies pindrow</i>	Sal	Pinaceae
3	<i>Atropa acuminata</i>	Chella lubbar	Solanaceae
4	<i>Berginia ligulata</i>	Zakhmi hayat	Saxifragaceae
5	<i>Cannabis sativa</i>	Bhang	Cannabaceae
6	<i>Cedrus deodara</i>	Divdar	Pinaceae
7	<i>Euphorbia wallichia</i>	Guri-dud	Euphorbiaceae
8	<i>Lavetera cashmeriana</i>	Sozposh	Malvaceae
9	<i>Oxalis corniculata</i>	Tsok-tsen	Oxalidaceae
10	<i>Podophyllum hexandrum</i>	Banwangun	Berberidaceae
11	<i>Pinus roxiburghii</i>	Chad	Pinaceae
12	<i>Prunella vulgaris</i>	Kalwauth	Lamiaceae
13	<i>Saussurea costus</i>	Kuth	Asteraceae
14	<i>Trillium govanianum</i>	Tripiter	Melanthiaceae
15	<i>Urtica dioica</i>	Soi	Urticaceae

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