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Life Form Spectrum of Zanübu Mountain Ecosystem of Phek District, Nagaland, India

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Abstract: Study was carried out to understand the life forms and biological spectrum of plants in Zanübu mountain ecosystem of Phek district of Nagaland. A total of 118 plant species belonging to 60 families and 95 genera were recorded. The life forms in order of importance were phanerophytes chamaephytes cryptophytes, hemicryptophytes and therophytes with 79, 12, 11, 10 and 6 species. The dominant two groups i.e., phanerophytes and chamaephytes constituted 77.12 % of the total plants' life, and thus exhibited a "Phanero-chamaephytic" phytoclimate. The climate is ideal for sustaining the forest trees, which in turn influence many ecosystem processes. The study revealed that hemicryptophytes and cryptophytes showed an increasing trend towards high altitude while therophytes and chamaephytes showed a decreasing trend. This indicates that some anthropogenic activities are operating in the lower altitude.

Keywords: Life form, Biological spectrum, Phytoclimate, Zanübu mountain ecosystem, Nagaland

The study of plant life forms is essential, because it provides the basic structural composition of vegetation and describes vegetation structure of a region. Plants provide many ecosystem services, and thus obtaining the floristic data is imperative to determine the plant wealth of a region (Wagay et al 2015). The floristic list of any area leads to the proper identification of plant species and thereby helps in conservation in a scientific and systematic way (Manan et al 2022). A life-form is the sum of all the plants' adaptation to certain ecological conditions (Devi and Devi 2020). The system of Raunkiaer's (1934) is the most widely accepted system for the description and classification of plant life forms, and is based upon the principle of position and degree of protection of the buds during the adverse climatic conditions. It consists of five main classes: phanerophytes, chamaephytes, hemicrytophytes, cryptophytes and therophytes. Plants with a similar life-form are likely to exhibit similar responses on the dominant ecosystem processes (Pausas and Austin 2001). Hence, the understanding of life form is an important aspect in ecological studies and vegetation description. The biological spectrum is the percent representation of the number of species belonging to each life-form in a given flora (Gazal and Raina 2015), and is a mirror reflection of the phytoclimate and floristic composition of the site (Sharma and Sharma 2018). 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 understudy (Reddy et al 2001). In northeast India, Devi et al (2014) reported "Phanero-therophytic" type of phytoclimate in hill forest of Manipur; Usharani et al (2015) reported "Phanero-chamaephytic" phytoclimate in the sacred grove of Manipur; Arila and Gupta (2016) reported "Phanero-therophytic" phytoclimate in lower elevation and "Phanero-cryptophytic" phytoclimate in higher elevation in Montane Forests of Senapati district of Manipur.

Study of floristic composition and life form is important to find out phytoclimate zones of a particular area (Sidanand and Kotresha 2012). Biological spectrum may be changed due to introduction of therophytes like annual weeds, biotic influences like grazing, deforestation and trampling, etc (Jadhav 2020). The biological spectrum may set the guidelines for eco-restoration and optimization of a community (Gazal and Raina 2015). The Zanübu Mountain is the highest mountain peak of Phek district, Nagaland. However, due to lack of investigation on the life forms and floristic composition, an attempt was made to study the life form and biological spectrum and floristic composition so as to compare the widely separated plant communities. This will also help in conservation of important plant species occurring in the area.

MATERIAL AND METHODS

Study area: The present study was conducted in Zanübu mountain ecosystem of Phek district, Nagaland. Mount Zanübu is the highest point at 2426 m above mean sea

level. Two study sites were selected. Site I occurs at lower elevation (1600-2000m amsl) and the forests range from subtropical to montane wet temperate forest, and lies between N25^{0}39 712' to N25^0 38 530' latitude and E94^0 22 051' to E94^0 21 753' longitude. Site II occurs at higher elevation (2001-2426m amsl) consisting of montane wet temperate forest and lies between N25^0 40 420' to N25^{0}39 794' latitude and E94^0 20 608'to E94^0 21 980' longitude. Phek district has temperate to subtropical climate. It enjoys moderately warm summer with average temperature of 27^{0}C and 32^{0}C as maximum temperature. Winters are cold and the temperature drops to 0^{0}C in the coldest months of January and February. It receives average annual rainfall of 1527mm. The soils are acidic in reaction with pH ranging from 4.15 to 5.74 (Poji et al 2017). The upper forests of Zanübu mountain ecosystem are conserved by seven surrounding Chakhesang villages. Activities such as logging and hunting are banned in these forests, and fines are imposed on the defaulters. However, some disturbances like seasonal hunting and trekking activities are still observed. The lower elevation forests are prone to anthropogenic activities like logging, hunting, shifting cultivation, grazing, collection of wild edible resources and commercial plantations. Plant samples were collected from January 2020- March 2022 using random sampling method.

Sampling and analysis: To study the life form of the plant community, six quadrats each measuring 50mx50m were laid in each study site. Within each of these quadrats, 10 random quadrats, each measuring 10mx10m for trees, 5mx5m for shrubs and 1mx1m for herbs were laid. Quadrats for shrubs and herbs were nested within the quadrat for trees (trees >10cm dbh, and herbs less than 1 m height). So 60 quadrats each for trees, shrubs and herbs were laid in each study sites. Hence, altogether 120 quadrats each for trees, shrubs and herbs were laid. The specimens of all the species occurring within the sampling plot were collected and herbarium was prepared (Jain and Rao 1977) and deposited in the Department of Botany, Nagaland University. The specimens were identified with the help of floras (Kanjilal et al 1934, 36, 38, 40) and herbaria of the department of Botany, Nagaland University, besides consulting some taxonomic experts. The nature of perennating buds of plant species was observed and the life form classes were worked out according to the life-forms system of Raunkiaer (1934). The biological spectrum of the area was constructed by calculating the percentage distribution of these species in different life forms. The percentage life-form was calculated as follows and were then compared with the normal spectrum given by Raunkiaer (1934)

$$\text{Percent life form} = \frac{\text{Number of species in a given life form}}{\text{Total number of species of all life forms}} \times 100$$

RESULTS AND DISCUSSION

The present study recorded a total of 118 species belonging to 61 families and 95 genera. The plant species recorded were assigned different life form classes based on the Raunkiaer' s system of classification (Table 1). These include 3 pteridophytes and 115 angiosperms with 100 dicots and 15 monocots. In terms of habit, trees were the most dominant with 45 species, followed by herbs with 39 species, shrubs 16 species, shrub to small trees 8 species, climber 8 species and shrub to vine 2 species. The most dominant families were Lauraceae with 12 species, followed by Asteraceae, Rosaceae and Urticaceae with 6 species each, Araliaceae with 5 species and Euphorbiaceae and Fagaceae with 4 species each. The most dominant genera were *Lindera* with 5 species followed by *Lithocarpus, Litsea, Prunus* and *Elatostema* with 3 species each. The genus *Betula, Brassiopsis*, *Cinnamomum*, *Hedychium, Impatiens, Macaranga, Magnolia, Persicaria, Phoebe, Rubus* and *Zanthoxylum* consist of 2 species each, while the rest of the genera had 1 species each. Site I recorded a total of 70 species representing 39 families and 62 genera, while a total of 73 species belonging to 40 families and 63 genera were recorded from Site II. In Site I, families with maximum species were Urticaceae and Rosaceae, while that in Site II were Lauraceae, Fagaceae and Urticaceae.

In the biological spectrum, the percentage representation of life-forms recorded in the study area reveals that phanerophytes were the most abundant life-forms with 79 species constituting 66.95 % of the total flora, followed by Chamaephytes (12 species, 10.17%), Cryptophytes (11 species, 9.32%), Hemicryptophytes (10 species, 8.47%), and lastly Therophytes (6 species, 5.09%). The number and percentage of species belonging to each life-form category relative to the total number of species in each site is presented in Figs. 1 and 2. The dominant life forms in biological spectrum of a region indicate the phytoclimate of that region (Sharma et al 2014, Thakur 2015, Bhattacharjya and Sarma 2016, Nasir et al 2016, Al-Hawshabi et al 2017). The dominant two groups (phanerophytes and chamaephytes) constituted 77.12 % of the total plants' life, and thus exhibit a “Phanero-chamaephytic“ phytoclimate. The climate is ideal for sustaining the forest trees. The dominance of phanerophytes helps to improve the micro-climate, control regeneration, establish herbaceous plants and maintain biodiversity, which are of vital importance in

Table 1. Plant species recorded and their life forms in Zanübu mountain ecosystem

Name of the species	Vascular plant	D/M	Family	Habit	Life form	Below 2000 m	Above 2000 m
Achyranthes aspera L.	A	D	Amaranthaceae	Herb	Th	+	+
Actinidia callosa Lindl.	A	D	Actinidiaceae	Shrub/Vine	Ph	-	+
Schefflera sp.	A	D	Araliaceae	Tree	Ph	+	+
Ageratina adenophora (spreng.) R. M. King & H. Rob.	A	D	Asteraceae	Herb	Ch	+	-
Ageratum conyzoides L.	A	D	Asteraceae	Herb	Th	+	-
Alnus nepalensis D.Don	A	D	Betulaceae	Tree	Ph	+	-
Anaphalis margaritacea (L.) Benth. & Hook.f.	A	D	Asteraceae	Herb	H	-	+
Arisaema consanguineum Schott	A	D	Araceae	Herb	Cr	+	-
Artemisia nilagirica (C.B. Clarke) Pamp.	A	D	Asteraceae	Herb	H	-	+
Asparagus racemosus Willd.	A	M	Asparagaceae	Herb	Cr	-	+
Athyrium sp.	P		Athyriaceae	Herb	Ch	+	-
Baliospermum calycinum Müll. Arg.	A	D	Euphorbiaceae	Shrub	Ph	-	+
Betula alnoides Buch.-Ham.ex D. Don	A	D	Betulaceae	Tree	Ph	+	+
Betula utilis D.Don	A	D	Betulaceae	Tree	Ph	-	+
Boehmeria macrophylla Hornem	A	D	Urticaceae	Shrub	Ch	+	+
Bidens pilosa L.	A	D	Asteraceae	Herb	Th	+	-
Brassaiopsis glomerulata (Blume) Regel	A	D	Araliaceae	Tree	Ph	+	-
Brassaiopsis hainla (Buch. - Ham.) Seem.	A	D	Araliaceae	Tree	Ph	+	+
Calanthe triplicata (Willemet) Ames	A	M	Orchidaceae	Herb	Cr	-	+
Campylendra wattii C.B. Clarke	A	M	Asparagaceae	Herb	H	-	+
Canarium sp.	A	D	Burseraceae	Tree	Ph	-	+
Carex baccans Nees	A	M	Cyperaceae	Herb	H	+	-
Celastrus sp.	A	D	Celastraceae	Shrub/ Vine	Ph	-	+
Cephalostachyum capitatum Munro	A	M	Poaceae	Shrub	Ph	+	+
Cinnamomum camphora (L.) J. Presl	A	D	Lauraceae	Tree	Ph	-	+
Cinnamomum verum J.S. Presl.	A	D	Lauraceae	Tree	Ph	-	+
Clematis sp.	A	D	Ranunculaceae	Climber	Ph	+	+
Commelina maculata Edgew.	A	D	Commelinaceae	Herb	Th	+	-
Cornus capitata Wall.	A	D	Cornaceae	Tree	Ph	-	+
Cyathea gigantea (Wall.ex Hook.) Holttum	P		Cyatheaceae	Tree	Ph	+	-
Cyperus rotundus L.	A	M	Cyperaceae	Herb	Cr	+	-
Cyphostemma auriculatum (Roxb.) P.Singh & B.V.Shetty	A	D	Vitaceae	Climber	Ph	+	-
Debregeasia longifolia (Burm.f.) Wedd.	A	D	Urticaceae	Shrub/ Small tree	Ph	+	-
Dichroa febrifuga Lour.	A	D	Hydrangeaceae	Shrub	Ph	-	+
Didymocarpus pulcher C.B.Clarke	A	D	Gesneriaceae	Herb	Cr	-	+
Diospyros sp.	A	D	Ebenaceae	Small tree/ Shrub	Ph	+	-
Disporum cantoniense (Lour.) Merr.	A	D	Colchicaceae	Herb	Cr	+	+
Dobinea vulgaris Buch.-Ham.ex D. Don	A	D	Anacardiaceae	Shrub	Ph	+	-
Drymaria cordata (L.) Willd. ex Schult.	A	D	Caryophyllaceae	Herb	Th	+	-
Elatostema acuminatum (Poir.) Brongn.	A	D	Urticaceae	Herb	Ch	+	+
Elatostema lineolatum Wight.	A	D	Urticaceae	Herb	Ch	+	+
Elatostema platyphyllum Wedd.	A	D	Urticaceae	Herb	Ch	+	+

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Table 1. Plant species recorded and their life forms in Zanübu mountain ecosystem

Name of the species	Vascular plant	D/M	Family	Habit	Life form	Below 2000 m	Above 2000 m
Engelhardia spicata Lesch. ex Blume	A	D	Juglandaceae	Tree	Ph	+	-
Eurya acuminata DC.	A	D	Theaceae	Shrub/ Tree	Ph	+	+
Exbucklandia populnea (R.Br. ex Griff.)R.W. Brown	A	D	Hamamelidaceae	Tree	Ph	-	+
Fagopyrum cymosum (Trevir.) Meisn.	A	D	Polygonaceae	Herb	Th	+	-
Hedera nepalensis K. Koch	A	D	Araliaceae	Climber	Ph	-	+
Hedychium densiflorum Wall.	A	M	Zingiberaceae	Herb	Cr	+	-
Hedychium spicatum Sm.	A	M	Zingiberaceae	Herb	Cr	-	+
Hovenia dulcis Thunb.	A	D	Rhamnaceae	Tree	Ph	+	-
Hydrocotyle javanica Thunb.	A	D	Apiaceae	Herb	H	-	+
Impatiens arguta Hook. f. & Thomson	A	D	Balsaminaceae	Herb	Ch	+	+
Impatiens pallida Nutt.	A	D	Balsaminaceae	Herb	Ch	+	+
Jasminum sp.	A	D	Oleaceae	Climber	Ph	-	+
Juglans regia L.	A	D	Juglandaceae	Tree	Ph	+	-
Leucosceptrum canum Sm.	A	D	Lamiaceae	Shrub	Ph	+	-
Lindera caudata (Nees) Hook.f.	A	D	Lauraceae	Shrub/ Small tree	Ph	-	+
Lindera pulcherrima (Nees) Benth	A	D	Lauraceae	Tree	Ph	-	+
Lindera supracostata Lecomte	A	D	Lauraceae	Shrub/ Small tree	Ph	-	+
Lindera sp. A	A	D	Lauraceae	Tree	Ph	+	+
Lindera sp. B	A	D	Lauraceae	Tree	Ph	-	+
Lithocarpus elegans (Blume) Hatus. ex Soepadmo	A	D	Fagaceae	Tree	Ph	-	+
Lithocarpus pachyphyllus (Kurz) Rehder	A	D	Fagaceae	Tree	Ph	-	+
Lithocarpus sp.	A	D	Fagaceae	Tree	Ph	-	+
Litsea cubeba (Lour.) Pers.	A	D	Lauraceae	Tree/Shrub	Ph	+	-
Litsea sp. A	A	D	Lauraceae	Tree	Ph	-	+
Litsea sp. B	A	D	Lauraceae	Tree	Ph	-	+
Lyonia ovalifolia (Wall.) Drude	A	D	Ericaceae	Tree	Ph	+	+
Macaranga indica Wight	A	D	Euphorbiaceae	Tree	Ph	+	-
Macaranga pustulata King ex Hook.f.	A	D	Euphorbiaceae	Tree	Ph	+	-
Macropanax dispermus (Blume) Kuntze	A	D	Araliaceae	Tree	Ph	+	-
Magnolia doltsopa (Buch. - Ham.ex DC.) Figlar	A	D	Magnoliaceae	Tree	Ph	-	+
Magnolia sp.	A	D	Magnoliaceae	Tree	Ph	-	+
Mahonia napaulensis DC.	A	D	Berberidaceae	Shrub	Ph	-	+
Malaxis sp.	A	M	Orchidaceae	Herb	Cr	-	+
Mallotus nepalensis Müll. Arg.	A	D	Euphorbiaceae	Tree	Ph	+	-
Melia azedarach L.	A	D	Meliaceae	Tree	Ph	+	-
Mimosa pudica L.	A	D	Fabaceae	Herb	H	+	-
Molineria capitulata (Lour.) Herb.	A	M	Hypoxidaceae	Herb	Cr	+	-
Musa sikkimensis Kurz	A	M	Musaceae	Herb	Ph	+	-
Neomicrocalamus prainii (Gamble) Keng f.	A	M	Poaceae	climber	Ph	+	+
Ophiopogon intermedius D. Don	A	M	Asparagaceae	Herb	H	-	+
*Oplismenus undulatifolius (*Ard.) Roem. & Schult	A	M	Poaceae	Herb	H	+	+
Osbeckia stellata Buch.-Ham.ex D.Don	A	D	Melastomataceae	Shrub	Ph	+	-

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Table 1. Plant species recorded and their life forms in Zanübu mountain ecosystem

Name of the species	Vascular plant	D/M	Family	Habit	Life form	Below 2000 m	Above 2000 m
Persicaria chinensis (L.) H. Gross	A	D	Polygonaceae	Herb	Ch	+	+
Persicria nepalensis (Meisn.) H. Gross	A	D	Polygonaceae	Herb	Ch	-	+
Phoebe hainesiana Brandis	A	D	Lauraceae	Tree	Ph	+	+
Phoebe sp.	A	D	Lauraceae	Tree	Ph	-	+
Phyllanthus tenellus Roxb.	A	D	Phyllanthaceae	Shrub	Ph	+	+
Pilea scripta (Buch. - Ham. ex D. Don) Wedd.	A	D	Urticaceae	Herb	Ch	+	-
Potentilla lineata Trevir.	A	D	Rosaceae	Herb	H	-	+
Prunus campanulata Maxim.	A	D	Rosaceae	Tree	Ph	+	+
Prunus cerasoides Buch.-Ham. ex D.Don	A	D	Rosaceae	Tree	Ph	+	-
Prunus nepalensis Ser. (Steud)	A	D	Rosaceae	Tree	Ph	+	-
Pteridium aquilinum (L.) Kuhn	P		Dennstaedtiaceae	Herb	Ch	+	+
Quercus lamellosa Sm.	A	D	Fagaceae	Tree	Ph	-	+
Rhododendron arboretum Sm.	A	D	Ericaceae	Tree	Ph	-	+
Rhus chinensis Mill.	A	D	Anacardiaceae	Shrub/ Small tree	Ph	+	-
Rubus ellipticus Smith	A	D	Rosaceae	Shrub	Ph	+	-
Rubus moluccanus L.	A	D	Rosaceae	Shrub	Ph	+	+
Sarcococca hookeriana Baill.	A	D	Buxaceae	Shrub	Ph	-	+
Saurauia napaulensis DC.	A	D	Actinidiaceae	Shrub	Ph	+	-
Schima wallichii (DC.) Korth	A	D	Theaceae	Tree	Ph	+	-
Senecio scandens Buch.-Ham.ex D. Don	A	D	Asteraceae	Climber	Ph	-	+
Smilax zeylanica L	A	M	Smilacaceae	Climber	Ph	+	-
Spondias pinnata (L.f.) Kurz	A	D	Anacardiaceae	Tree	Ph	+	-
Symplocos sp.	A	D	Symplocaceae	Tree	Ph	-	+
Syzygium cumini (L.) Skeels	A	D	Myrtaceae	Tree	Ph	+	-
Tetrastigma lanceolarium (Roxb.) Planch.	A	D	Vitaceae	Climber	Ph	+	-
Trema orientalis (L.) Blume	A	D	Cannabaceae	Tree	Ph	+	-
Turpinia sp.	A	D	Staphyleaceae	Tree	Ph	-	+
Valeriana jatamansi	A	D	Caprifoliaceae	Herb	Cr	-	+
Viburnum cylindricum Buch.- Ham.ex D.Don	A	D	Adoxaceae	Shrub	Ph	-	+
Viola pilosa Blume	A	D	Violaceae	Herb	H	-	+
Vitex quinata (Lour.) F.N. Williams	A	D	Lamiaceae	Shrub	Ph	+	-
Zanthoxylum armatum DC.	A	D	Rutaceae	Shrub	Ph	-	+
Zanthoxylum oxyphyllum Edgew.	A	D	Rutaceae	Shrub/ small tree	Ph	-	+
Zizyphus incurva Roxb.	A	D	Rhamnaceae	Tree	Ph	+	+

Ch- Chamaephyte; Cr- Cryptophyte; H- Hemicryptophyte; Ph- Phanerophyte; Th- Therophyte, A- Angiosperm, G- Gymnosperm, P- Pteridophyte, D- Dicot, M- Monocot

Table 2. Number of species recorded in the two sites and comparison of biological spectrum of Zanübu mountain range of Phek district, Nagaland, with Raunkiaer's normal spectrum

Life form classes	Species recorded		Life-form (%)		Raunkiaer's normal spectrum (%)
	Site I	Site II	Site I	Site II	
Phanerophytes	45	48	64.29	65.75	46
Chamaephyte	11	9	15.71	12.33	9
Hemicryptophyte	3	8	4.29	10.96	26
Cryptophyte	5	7	7.14	9.59	6
Therophyte	6	1	8.57	1.37	13

influencing ecosystem processes (Devi et al 2014, Arila and Gupta 2016). Jamir et al (2006) reported that rainfall appears to be the most important operative factor in the evolution of biological spectrum, because the montane humid forests of Meghalaya which receive annual rainfall of 1200mm represented 51% of phanerophytes. The present study area, receiving an average annual rainfall of 1527mm also comes under the category of montane wet temperate forest of Nagaland, and represents 66.95% of phanerophytes, thus revealing the dominance of phaenerophytic climate.

Altitude is the main factor influencing both biodiversity and vegetation structure (Arila and Gupta, 2016). This study indicates that the life-form pattern clearly changes along the altitudinal gradient. In the present study, hemicryptophytes and cryptophytes showed an increasing trend towards high altitude while therophytes and chamaephytes showed a decreasing trend. Hussain (2009) highlighted that in open physiognomies, hemicryptophytes prevail, whereas in dense ones phanerophytes is the best representation class. The Zanübu mountain ecosystem is surrounded by a number of villages, and the lower elevation forest is subjected to anthropogenic activities such as grazing, hunting, firewood collection, shifting cultivation and collection of wild edible plant resources, as the forest is a source of livelihood to the rural people. A comparison of biological spectrum of the study area with Raunkiaer's (1934) normal biological spectrum (Table 2) reveals that phanerophytes, chamaephytes, and cryptophytes constituted higher percentages (66.95%, 10.17% and 9.32%, respectively) than the Raunkiear's normal spectra, while hemicryptophytes (8.47%) and therophytes (5.09%), were comparatively smaller in percentage than the Raunkiaer's normal spectra (Table 2). In the present study, a good percentage of phanerophytes in both the study sites indicate a humid bioclimate and its predominance along the altitudinal gradient reflected a significant role of the tall trees with their dense close canopy in enhancing humidity in the atmosphere thereby providing excellent conditions for the luxuriant growth of various types of ferns, mushrooms, and various medicinal herbs. The higher percentage of chamaephytes reflects the performance of chamaephytes in affecting other associated species through their competitive ability, and hence, the site facing anthropogenic stress show majority of chamaephytes (Devi et al 2014). The higher percentage of cryptophytes than the Raunkiear's normal spectra reflects the performance of Cryptophytes in withstanding unfavourable conditions as they have underground perennating organs like rhizomes, bulbs etc. from which they draw their energy during these unfavourable conditions.

A similar biological spectrum of different areas shows similar climatic conditions (Manan et.al, 2022).The climate of a study area differs from subtropical; moist temperate to sub-alpine meadow type vegetation at different altitudes (Khan et al 2015 and 2016). The climate of Zanübu mountain range vary from temperate to subtropical climates and the dominant life forms revealed the phytoclimate to be “phanero-chamaephytic” type. Similar to our findings, Usharani et al (2015) reported “phanero-chamaephytic” type of phytoclimate in the Konthoujam Sacred Grove in Manipur, India. A sacred grove is a patch of vegetation which is left undisturbed because of its association with some deity.

CONCLUSION

Analysis of life forms gives a clear picture of the biological spectrum of the Zanübu mountain ecosystem and revealed the phytoclimate to be ”phanero chamaephytic“ type in both the two sites. The present study reveals that phanerophytes, chamaephytes, and cryptophytes constituted higher percentages than in Raunkiear's normal spectra, while hemicryptophytes and therophytes were comparatively smaller in percentage than in Raunkiaer's normal spectra. In the higher elevation site (Site II), the prevalence of “phanero-chamaephytic” type of phytoclimate, with hemicryptophytes and cryptophytes as the third and fourth dominant life form classes respectively, indicates the fairly undisturbed status and protection of the forest through community conservation

efforts, inspite of the presence of some disturbances. In the lower elevation site (Site I), the prevalence of "phanero-chamaephytic" type of phytoclimate with therophytes as the third dominant life form class clearly indicates that some anthropogenic activities are operating in the lower altitude. This study can serve as baseline information for use by policymakers to develop conservation plans for the sustainable use of plant resources and to protect economically valuable flora by educating the native communities residing there.

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