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PLANT COMMUNITIES OF SOME NORTHERN TEMPERATE FORESTS OF PAKISTAN

Moinuddin Ahmed*

Summary

A quantitative botanical survey was undertaken along the way of Gilgit to Chilas and from Gilgit to Astore (dry temperate). Thirty stands were sampled. On the basis of index of similarity, dominant species and floristic composition fifteen coummunity types were recognised. The area shows three ecogeomorphological regions which differentiated into various habitats. Rainfall, temperature altitutde, plant cover and vegetation composition show wide variation in the different sectors of the study area.

1. INTRODUCTION

Quantitative ecological studies in Northern part of Pakistan are fragmentary. Kazmi and Siddiqui (1953) listed the medicinal plants of Astore while Nasir and Webster (1965) described the vegetation and flora of Hushe Valley. Ahmed (1976) published a multivariate analysis of vegetation from Skardu. Ahmed and Qadir (1976) and Ahmed (in press) presented plant communities along the way of Gilgit to Gopies, Yasin and Shunder and From Gilgit to Passue (Silk Road) respectively. However no quantitative or phytosociological work has been published from Gilgit and along the way of Gilgit to Chilas and from Gilgit to Astore. In addition it is reported that due to increasing population and biotic disturbance, natural vegetation of some parts of Northern areas in being taken over by semi-natural vegetation (Ahmed and Qadir, 1976). Therefore, it is concluded that human disturbance may also affect vegetational pattern of the study area. In view of this, the author started to explore the prevailing environmental conditions and their effect on the pattern and the distribution of plant communities. This may also allow a comparasion in future.

The study area

The study area lies between 35° to 36°N and 73° to 74°E in the Northern part of Pakistan. The study area is represented by three physiographic regions, these regions are also differentiated by different ecogeomorphology with different habitats.

1. *Gilgit*

It is located in the wert of Kashmir is mainly drained by the River Gilgit which flows eartward to join the Indus River above Bunji. Deeply sunken narrow Valley, surrounded by elevated mountains (from 10000 to 16000 feet) is located on 4500 feet above sea level. Study area lies within dry temperate zone. Climate is described by Ahmed and Qadir (1976).

*Botany Department, University of Baluchistan, Quetta, Pakistan.

2. *Chilas*

The area is lower than Gilgit with wider valley, located about 80 miles on southeast to Gilgit along the bank of the River Indus. Surrounding mountains are upto 10000 feet above sea level. The area comprises a sand dunes system due to soil erosion. Chilas is warmer than Gilgit. The July is the hottest month (mean monthly maximum temperature 52.4°F) and January is the coldest month (mean monthly maximum temperature 52.4°F). Highest relative humidity (66%) occur in January while lowest humidity is recorded in the month of June. Wind speed varied from 1.2 to 6.2 miles per hrs. The mean annual rainfall is 7.38. This area like Gilgit also falls within dry temperate zone (Hussain, 1984).

3. *Astore*

The study area of Astore is much higher than Gilgit and Chilas study areas and is located on the south west about 70 miles to the Gilgit. It is surrounded by snow covered peaks (i.e. Nangaparbat, 26660 feet). The area lies within the moist temperate zone. July is the hottest (81°F monthly maximum) while January is the coldest month (35.4°F. mean monthly maximum). Minimum temperature goes up to 18.5°F. Summer is short ranging from June to August. Highest relative humidity (80%) occurs in the month of January and lowest (50%) in the month of June. Wind speed ranges from 2.5 to 4.5 miles per hrs. The mean annual rainfall is 18.95 and most of which is received during the month of February to May.

2. MATERIAL AND METHODS

A point Centered Quarter method (Cottom and Curtis, 1956) was adopted to evaluate the quantitative vegetational composition of thirty stands in the study area. At each stand twenty points were taken. Eight stands were sampled at Gilgit, while along the way of Gilgit to Chilas and Gilgit to Astore, eleven stands for each areas were analysed. Generally sampling was restricted to least disturbed stands.

Phytocenological characteristics like relative frequency, relative density and relative basal area were calculated according to the methods described by the Muleller-Dombois and Ellenberg (1974). For tree species diameter at breast hight (dhb) were measured and than transferred it into the basal area. Nomenclature generally followed after Stewart (1972).

Since importance values show the relative ecological importance of each species in a stand (Brown and Curtis, 1952), importance values for each species were calculated. The species attained highest importance value was considered the dominant species of a stand. Similarity coefficient (Bray and Curtis, 1952) was used for comparing stands. Stands showing higher similarity (55%) were grouped together and various community types were recognised.

3. RESULTS

The vegetation of the study area shows recognizable units differenciated on the basis of

index of similarity, dominant species, vegetation composition and the prevailing habitat. Out of fifteen communities recognized, four communities are confined to Astore. These communities are dominated by tree species. The remaining eleven communities are characterised by shrubs and hurbs. Summary of quantitative analyses is given in table 1.

Plant communities

1. *Heliotropium dasycarpum community*

This is the most widespread community of the Gilgit and Chilas area. It has not been recorded at Astore. Other important associates of the community are *Tribulus terrestris, Haloxylon griffithii, Salsola-kali* and *Capparis spinosa*. The community is recorded on deep sandy soils as well as shallow soils.

2. *Salsola Kali community*

The community is confined to only one area at Gilgit, indicating highly disturbed conditions, *Peganum harmala, Tribulus terrestris* and *Heliotropium dasycarpum* are also present. However, first two species also show the sign of disturbance. The ground surface is rocky with a thin layer of soil. The plant cover is considerably low.

3. *Haloxylon griffithii community*

This species was recorded at seven different locations from Gilgit and Chilas. However, it formed a community at one place (Gilgit) only. The only member of this community was *Capparis spinosa*. The ground surface is characterised by boulders with shallow surface depoits in patches, which held the dominant species. *Capparis spinosa* was growing on bare rocks, penetrating its roots in the cracks.

4. *Artemisia scoparia community*

This community occur at Gilgit and 15 miles away from Chilas. Other recorded species are *Chenopodium botrys, Artemisia vulgaris, Tribulus terrestris* and *Heliotropium dasycarpum*. First two associated species are found near Chilas. All the species have low cover values. The community found on alluvial deposit with slightly increased moist condition as compared to previously described communities.

5. *Capparis spinosa community*

The community abounds in terraces, valleys and gentle slopes. In most places ground surface is rocky or gravelly. However, near Gilgit it occurs on deep sandy soils having *Heliotropium-dasycarpum* and *Tribulus terrestris*. Near Chilas these species are replaced by *Amaranthus* sp., *Tamarix* sp., *Artemisia vulgaris, Kochia stellaris* and *Cousinia* sp. Plant cover is higher

in comparison to communities described above and the dominant species contributes most. This is the most widely distributed community of the Gilgit and Chilas area.

6. *Sophora alopecuroides community*

It is confined to only one place near Chilas with higher basal area value than the *Capparis spinosa* community. The species shows the sign of disturbance and grows in a thick patches in the stand. Though the species widely distributed in Gilgit but does not attain a size of a community. It is found on low land area on a sandy soil with *Artemisia vulgaris, Heliotropium-dasycarpum, Amaranthus* sp. and *Cousinia* sp.

7. *Artemisia vulgaris community*

Though this species was recorded from many places at Chilas and Astore but it formed a community only near Chilas. The soil was deep and formed mainly of course sand. *Heliotropium-dasycarpum* and *Artemisia scoparia* were the only members of this community.

8. *Amaranthus sp, community*

It occurs in Chilas on alluvial deposits. Due to its physiographic location, runoff water accumulates for longer time in this habitat. Plant cover is high. The consistent associates are *Capparis spinosa, Haloxylon griffithii* and *Tribulus terrestris.* Last two species are poorly represented.

9. *Ephedra gerardiana community*

The community was confined on the dry stream bed of the river Indus near Partab Bridge along the way of Gilgit to Astore and Chilas. In that area it formed dense patches with *Heliotropium dasycarpum*. The cover is higher mainly contributed by the dominant species.

10. *Tamarix sp. community*

The community was recorded along the bank of river Indus near chilas. The ground surface was coarse sandy with gravells deposited by the river. *Capparis spinosa* was other important associate growing on the upper portion of the river. *Heliotropium dasycarpum, Aristida* sp. and *Cousinia* sp. supported by the alluvial deposit with low values.

11. *Periphoca aphyla community*

This community has a limited geographical distribution in the study area. It occurs in mountainous valley, about 15 miles before Astore. The species is widely distributed in the stand on gentle slope. The ground surface is rocky. *Haloxylon griffithii, Kochia stetleris* and *Massusium vulyaris* are present with poor values.

12. *Fraxinus xanthoxyloides community*

It is the first small sized tree community recorded 2 miles before Harcho Valley along the way of Astore, on moderate slopes. Due to cutting and grazing the species is growing in a scattered form. *Artemisia vulgaris* is the only member of the community. The dominant species is also recorded on the banks of dry streams, near springs and water courses. The community occurs on rocky, gravelly and coarse sandy surfaces at about 5500 feet above sea level.

13. *Juniperus polycarpus community*

It occurs at altitude above 5500 feet on moderate to steep slopes as well as gentle slopes. Grazing and cutting is practiced in this community. Habitat is severly affected by these factors alongwith soil erosion. Many places ground surface is covered with boulders. Lower sides are associated with *Artemisia vulgaris* while upper sides contain *Rosa webbiana* and *Berberis vulgaris* alongwith a few scattered individuals of *Pinus roxburghii.*

14. *Pinus roxburghii community*

This species formed a community above 6000 feet at Harcho valley. *Juniperus polycarpus* and *Fraxinus xanthoxyloides* were the important members, forming a mixed type of community. However *Pinus roxburghii* was dominated on the basis of highest importance value. The ground surface was occupied by *Berberis vulgaris, Cousinia* sp. and *Rosa saxatilis.* The community was supported by fine textural soil. The water revenue was much higher than previous communities. At the elevation of 7000 feet and above (one mile before Astore) the community was associated by *Pinus wallichiana* and a few scattered individuals of *Abies pindrow.*

15. *Pinus wallichiana community*

Previously described community was taken over by the *Pinus wallichiana* community about 8000 feet on Astore (Near Rama Rest House). The valley was surrounded by snow covered peaks (i–e Nanga Parbat 26600 feet). Due to cutting and grazing herbs and shrubs species were not recorded. The ground surface was covered by a thick carpet of lower plants. In some places community formed a pure stands with a few tree of *Abies pindrow.* However on 8500 feet *Abies pindrow* became a important associated species forming a mixed type of forest. In this community *Juniperus turstania* formed a second strata.

4. DISCUSSION

Vegetation of the study area was dominated by various life forms, i–e herbs, shrubs and trees. Gilgit and the way of Chilas was characterised by herbs and shrubs while Astore was occupied by tree species. Gilgit and Chilas both lie in the dry temperate region showing different geomorphology and habitat. Amount of rainfall and temperature is also different. Therefore both areas show variation in vegetation composition and communities. *Salsola kali* and *Haloxylon griffithii* were confined to Gilgit while communities like *Artemisia vulgaris, Ephedra*

gerardiana, Amaranthus sp., *Tamarix* sp. and *Spohora alopecuroides* were abandoned along the way of Chilas. *Heliotropium-dasycarpum, Artemisia scoparia* and *Capparis spinosa* were common in both places. All these species have wide ecological amplitude and reported from all dry temperate forests as well as dry subtropical submountainous regions of Baluchistan. According to Ahmed (1974, 1976), Ahmed and Qadir (1976) and Ahmed (1984) *Capparis spinosa, Haloxylon graffithii, Ephedra gerardiana* were widely distributed in Skardu., along the way of Gopies, Shunder and Passue. Tareen (1986) and Arif (1984) reported these species from some parts of Baluchistan.

Beside differences in local topography and in amount of rainfall, the pattern and distribution of various species also controlled by the human disturbance at Gilgit and Chilas. It was experienced that *Pegauum hermala, Salsola kali, Haloxylon graffithii, Sophora alopecuroides, Amaranthus* sp. *Tribulus terrestris* always appeared after the cutting of the vegetation. Thus the presence of these species showed the sign of disturbance. Therefore though the climatic condition of Gilgit was more favourable than Chilas for plant growth, the vegetation cover of Gilgit was considerably low and sparse.

The changes in pattern of vegetation and composition of species were more apparent from Gilgit to Astore. Vegetation and its cover changed gradually from Gilgit and Chilas to Astore with increasing altitude and amount and pattern of rainfall. At the foothills of Astore *Periphoca-aphyla* appeared as a dominant species while higher slopes were occupied by *Juniperus polycarpus* and *Fraxinus xanthoxyloides*. Latter two tree species were recorded 5500 to 6000 feet in the study area. However these species occupied higher altitude in other dry temperate forests of Pakistan. Ahmed and Qadir (1976) reported these species from Shunder on higher altitude and in Baluchistan *Juniperus polycarpus* grows up to about 9000 feet. In Astore these communities showed a transition zone between dry and moist temperate condition due to presence of scattered individuals of *Pinus roxburghii*. Upto this region a dominant specie of Chilas, *Artemisia vulgaris* was recorded abundantly.

Above 6000 feet, dry temperate forest vegetation was completely taken over by moist temperate forest vegetation indicating *Pinus roxburghii* as a dominant species. The study area in this portion extended into the region which also received summer rains in addition to metting water. The high cover was also supported by deep sediments, structural fertile soils with definite horizons. Therefore vegetation composition, plant communities, plant life and habitat was absolutely different from Gilgit and Chilas.

At 8000 feet *Pinus roxburghii* was replaced by *Pinus wallichiana* and *Abies pindrow*. In contrast to lower parts, these species occupied highest basal area.

Present study shows that physiographic condition, altitude, edaphic conditions, amount and pattern of rainfall differ in three regions, hence obviously influence the water revenue of the various habitats. Consequently plant life, vegetation composition and plant cover considerably differ from one locality to other.

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Table 1. Summary of quantitative sampling

Name of the species	Presence	Importance value Max.	Cover in % Range	Dominant position in stands 1st	2nd
Heliotropium- dasycarpum	15	219.35	5–30	3	9
Tribulus terrestris	9	49.06	1–5	–	3
Salsola kali	2	134.53	3–8	1	–
Haloxylon griffithii	7	177.11	5–16	1	2
Peganum hermala	2	13.61	LO	–	–
Artemisia scoparia	5	149.86	10–19	3	1
Chenopodium sp.	1	48.58	5	–	1
Centaurea. sp.	2	10.77	LO	–	–
Matthiola. sp.	2	7.27	LO	–	–
Capparis spinosa	8	178.22	20–41	6	2
Sophora alopecuroides	2	190.39	10–20	1	–
Artemisia vulgaris	9	132.38	8–31	1	6
Kochia stellaris	2	47.86	2–5	–	1
Amaranthus. sp.	3	140.13	5–15	1	–
Ephedra gerardiana	1	178.67	46	1	–
Periphoca aphyla	1	167.39	45	1	–
Massusium vulgaris	1	16.52	LO	–	–
Temarix sp.	1	195.31	41	–	–
Aristida sp	1	36.32	3	–	–
Cousinia sp.	3	40.42	2–6	–	–
Saccharum sp	1	35.31	6	–	–
Fraxinus xanthoxyloides	3	148.72	18–22	3	–
Juniperus polycarpus	5	216.36	10–33	3	–
Juniperus turstania	1	77.01	15	–	–
Rosa webbiana	2	57.39	5	–	1
Berbaris vulgaris	2	35.12	4	–	1
Pinus roxburghii	4	267.60	5–50	3	–
Pinus wallichiana	4	289.72	7–60	2	1
Abies pindrow	3	189.30	10–39	–	2

Note: LO = Less than one precent cover, Max. = Maximum, Ave. = Average.

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