# PHYTOSOCIOLOGICAL STUDIES ALONG THE WAY OF GILGIT TO GOPIS YASIN AND PHUNDER

*by*

**Moin Uddin Ahmed***

and

**Dr. S.A. Qadir****

**Summary.** *Quantitative phytosociological survey was carried out along the way of Gilgit to Gopis, Yasin and Phunder. Vegetation was sampled at 46 different locations by quadrat and plotless methods. Community attributes, maturity and homogeneity of every stand were studied. 10 communities were recognised on the basis of physiognomy, floristic composition and importance value index.*

**Introduction.** Gilgit, Gopis, Yasin and Phunder are extremely high mountainous regions with snow covered and glaciated Peaks. At some places, where the valleys are wide and at the junction with major tributaries, extensive alluvial terraces and fans are formed, marginal to the river.

The mountainous topography of the area has extended since the tertiary period when the region was subjected to prolonged orogeny. The mountain chains are alligned parellel to the original geological structure and this distribution depends on the difference of weathering of the rock type. Glaciation has played an important role in producing the rugged topography. Glacial erosion reached its maximum during the pleistocene epoch but the ice has since receded to much higher altitudes. Undisturbed high level river gravels, on the sides of valleys, show that the river has cut several hundred feet since the last orogeny. Alluviation has occurred due to blockage, by river of the glacial or landslide debris and resulting terraces have differnt levels. The main rock types are slate, quartzite, schist and gneiss.

According to Ahmed (1951) whole of the Northern area falls in subtropical continental highlands (cold snowy winter, mostly arid with mainly winter and spring rains). The meteorological data of last 10 years shows that in Gilgit, September is the hottest month with the mean monthly maximum temperature of 97.6°F, while January is the coldest month with the mean minimum monthly temperature 27.1°F. The summer season is very short lasting from June to September. Relative humidity is much higher at 8 A.M. than at 5 P.M. The

*Department of Botany, University of Karachi.
**Department of Botany, University of Tripoli, Libya.

highest relative humidity occurs in January (76%) and lowest in June (38%). The average annual rainfall is 6 inch most of which is received during April and May. The wind speed is not very high, it varies between 1.4-3.4 miles hour during whole year and blows mostly from South to West.

Yasin and Gopis are colder than Gilgit. July is the hottest month with the mean monthly maximum temperature 89°F and January is the coldest month with the mean minimum monthly temperature 15.5°F, being below freezing point. The summer season is very short ranging from June to August. Highest relative humidity occurs in the month of February (57%). Wind speed ranges from 2.9 to 6 miles/hour. Rainfall is less than 3 inchs.

Meteorological data about Phunder is not available.

**Material and Methods.** *Field Methods:* The quantitative phytosociological, survey was done in the month of June and continued till the month of August, 1974. Community attributes like relative cover, relative density, relative frequency and importance value index of 46 different stands were collected and data is summarized in table I. In the field, quadrat method (size 10 × 10 or 5 × 5 feet according to vegetational condition) and, among the mean area methods, Cottom and Curtis (1956). Random pairs method and point centered Quarter method were applied. Along the way of Gilgit to Gopis, Yasin and Phunder nearly all the stands were to some extent disturbed and efforts were made to sample the least disturbed stands.

*Maturity:* Pichi Sermollis (1948) Community maturity index was used for determining the maturity of the Community.

*Homogeneity:* For measurement of the Homogeneity of the communities Raunkiaer's law of frequency (1934) was applied.

**Results.** After a quantitative study of the area, it became apparent that the whole vegetation complex could be classified into 10 communities, according to the physiognomy, floristic composition, index of similarities and importance value index. The various communities are given below:—

1. Capparis spinosa, Artemisia vulgaris, Haloxylon griffithii, community:
   All these three species (Fig. 1) were abundant, having high importance value index (I.V.I.). Other associates were *Artemisia scoparia*, *Amaranthus* sp., *Tribulus terrestris* and *Chenopodium botrys*. *Rosa webbiana* and *Prunus* sp. were also present as scattered plants. The community is open, unstratified and homogeneous.

2. Ephedra gerardiana-Heliotropium dasycarpum—Capparis spinosa community:

   This community occurs at seven different places. Other members of this community are *Artemisia vulgaris*, *Tribulus terrestris*, while *Rosa webbiana*, *Grewia* sp., *Juniperus* sp. and *Lactuca tatarica* were present with very low I.V.I.

Fig. 1. *Artemisia vulgaris* in the foreground along the way of Gilgit to Gopis.

Fig. 2. *Haloxylon griffithii*, on the way of Yasin.

Fig. 3. Pure stand of Tamarix sp., on the bank of river Indus, near Gilgit.

Fig. 4. *Myricaria a germanica*, on a river bank, on the way of Gilgit to Gopis.

Table I

*Summary of phytosociological data*

| | Name of plant | Point of occurrence | Maximum I.V.I. | Total I.V.I. | Average I.V.I. | No of stands in which as deminas | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Ist | 2nd | 3rd |
| 1. | *Ephedra gerardiana* Wall. ex Stapf. | 13 | 100 | 612.45 | 47.11 | 6 | 4 | — |
| 2. | *Capparis spinosa* L. | 12 | 100 | 452.05 | 37.67 | 11 | 4 | — |
| 3. | *Artemisia vulgaris* L. | 13 | 83.33 | 362.46 | 27.88 | 4 | 3 | 1 |
| 4. | *Haloxylon griffithii* (Moq) Bunge ex Boiss. | 14 | 76.42 | 439.15 | 31.36 | 3 | 3 | 3 |
| 5. | *Fraxinus xanthoxyloides* (Wall. ex G. Don) DC | 5 | 70.00 | 233.33 | 46.66 | 3 | 2 | — |
| 6. | *Tamarix* sp. | 7 | 61.53 | 216.24 | 30.89 | 6 | — | — |
| 7. | *Juniperus* sp. | 6 | 70.00 | 210.71 | 35.11 | 3 | — | 2 |
| 8. | *Rosa webbiana* Wall. ex Royle | 9 | 46.66 | 184.10 | 20.45 | — | 2 | 5 |
| 9. | *Heliotropium dasycarpum* Ledeb. | 15 | 73.07 | 539.64 | 35.97 | 5 | 5 | 1 |
| 10. | *Tribulus terrestris* L. | 13 | 36.36 | 259.06 | 19.92 | 1 | 4 | 5 |
| 11. | *Sophora alopecuroides* L. | 6 | 25.71 | 141.07 | 23.51 | 1 | 1 | 4 |
| 12. | *Artemisia scoparia* Waldst. and Kit. | 8 | 40.0 | 158.18 | 19.77 | 2 | 4 | — |
| 13. | *Salsola kali* L. | 7 | 37.03 | 148.54 | 21.22 | — | 3 | 1 |
| 14. | *Chenopodium potrys* L. | 7 | 23.54 | 95.34 | 13.62 | 1 | 2 | 2 |
| 15. | *Lactuca tatarica* (L.) C.A. Mey. var. *tibetica* Hk.f. | 3 | 28.22 | 50.88 | 16.96 | — | — | 1 |
| 16. | *Myricaria germanica* (L.) Desv. | 3 | 33.33 | 50.40 | 16.80 | — | 2 | — |
| 17. | *Berberis vulgaris* Aithch. non L. | 2 | 16.66 | 32.03 | 16.01 | — | — | 2 |
| 18. | *Alhagi maurorum* Medic. | 1 | 30.30 | 30.30 | 30.30 | 1 | — | — |
| 19. | *Amaranthus* sp. | 4 | 18.20 | 35.52 | 8.88 | — | — | 1 |
| 20. | *Kochia stellaris* Moq. | 2 | 17.85 | 30.35 | 15.17 | — | 1 | 1 |
| 21. | *Peganum harmala* L. | 2 | 7.14 | 10.84 | 5.42 | — | — | 1 |

3. Haloxylon griffithii—Tribulus terrestris—Chenopodium botrys community:

These species form pure stands at two locations. *Haloxylon griffithii* was present due to saline condition of the soil. No other species was present in the community.

4. Chenopodium botrys—Artemisia scoparia—Peganum harmala community:

This community was present near Hyam valley, showing disturbance. Other associates were *Salsola kali*, *Tribulus terrestris* and *Artemisia vulgaris*. It forms a mature, homogeneous, unstratified and open community.

5. Alhagi maurorum—Salsola Kali—Amaranthus community:

This community was found at only one place, showing disturbed condition. This was an open, unstratified, immature and heterogeneous community. Other members of this community were *Chenopodium* sp., *Artemisia scoparia* and *Haloxylon griffithii*.

6. Tamarix sp.—Myricaria germanica—Sophora alopecuroides community:

This type of community was located near the bank of the river (Fig. 3,4) where alluvial soil and a lot of moisture was present. In these stands *Heliotropium dasycarpum* and *Salsola kali* form second stratum. *Pharagmites*, *Typha* were present at some places, while *Rosa webbiana* was also present with very low frequency. Community was close, stratified, mature and homogeneous.

7. Fraxinus xanthoxyloides—Juniperus sp.—Rosa webbiana community:

This community was found near Yasin, Shamara and Batreet valley (Fig. 5). It was observed that along the road or bank of the river Indus, *Fraxinus xanthoxyloides* was dominating (Fig. 6) but outside the road and lower to upper slopes of the mountains *Juniperus* sp. becomes dominating over it. *Prunus* sp. was also found. Due to cutting, these three species could not attain the tree size. *Ephedra gerardiana*, *Lactuca* sp., *Artemisia vulgaris* and *Rosa webbiana* grow under first two dominant species and form 2nd stratum.

At some places the community shows high maturity, homogeneity and stratification.

8. Sophora alopecuroides—Kochia stellaris—Berberis vulgaris community:

This community was present at only two stands, showing disturbed condition (Fig. 7).

9. Tribulus terrestris—Salsola kali—Sophora alopecuroides community:

This community was present near Singal valley. *Sophora alopecuroides* was present with very low I.V.I.

Fig. 5. *Juniperus* sp. and *Fraxinus Xanthoxy loides* near Phuder.

Fig. 6. *Fraxinus Xanthoxy loides* and *Rosa webbiana* along the way of Gopis to Phunder.

Fig. 7. *Sophora alopecuroides* and *Tamarix* sp., with Salsola Kali in second stratum, near Gopis.

10. Heliotropium dasycarpum—Haloxylon griffithii—Rosa webbiana community: This community was present at Pingle, Phunder and Gopis valleys. Rosa webbiana was present as scattered plants with very low I.V.I.

The study reveals that out of the 46 stands, 10 stands were immature while 35 stands were considered as homogeneous (Table II). It also shows that 41.31% stands were homogeneous due to higher value in class. While 17.07% stands were to some extent, homogeneous, 23.91% stands showed very poor homeogeneity. When the A.B.C. classes are relatively higher, the stands are not considered homogeneous, as in the case with the stand Nos. 4,5,7,9,11,15,20,23,35 and 37. In general, the higher the class E the greater is the homogeneity. Although some stands are affected due to impact of human civilization, i.e. disturbance, yet a clear correlation is found between the maturity and the homogeneity of the stands. Table II also indicates that the homogeneous stands tend to show higher maturity index as is true of stand Nos. 14,28,29,30,33,40, 41,42,44 and 46.

## Discussion and Conclusion

Phytosociological survey was carried out around Gilgit, along the way of Gopis, Yasin and Phunder valleys. Except for a few sites in some locations, the vegetation of the whole area under study was more or less disturbed. Therefore, the least disturbed and some disturbed stands were sampled. The extensive interference are grazing and cutting although the mountains have rocky and dangerous steep surface.

The mountains are dry and the available water to plants is only due to frost and melting snow. The vegetation is rich in herbaceous and shrubby flora, composed of about 32 different species. Some tree species were also present, but, except some locations, no clear stratification has been found and communities were open. The characteristic vegetation of mountain is that of true or adaptive xerophytes which were found to grow on the slope, over the top, in the crevices and upon the bare rocks. All the plants found on mountains or valleys were represented on the slopes but only a few species are met with on the top and higher slopes of the mountain. Moreover, the vegetation is denser on the slopes. Higher slopes and top of the mountain could not be studied.

The whole area is characterized by the following species, according to their decreasing I.V.I.:

1. *Ephedra gerardiana*,
2. *Heliotropium dasycarpum*
3. *Capparis spinosa*,
4. *Haloxylon griffithii* and
5. *Artemisia vulgaris*

Among the tree species or tall shrubs, *Fraxinus xanthoxyloidea*, *Juniperus* sp., *Prunus* sp. and *Rosa webbiana* were found abundantly on the lower to higher slopes, while on the lower slopes, crevices and in the cracks, *Capparis spinosa* and *Ephedra gerardiana*

Table II—**Maturity and homogeneity of the Stands**

| Stand No. | Maturity index | Frequencies of Frequency classes. A > | B > | C ≤ ≥ | D < | E |
|---|---|---|---|---|---|---|
| 1. | 47 | 50 | — | 25 | — | 25 |
| 2. | 37 | 40 | — | 40 | — | 20 |
| 3. | 67 | 25 | — | 25 | — | 50 |
| 4. | 42 | 50 | 12.50 | 12.50 | 25 | — |
| 5. | 40 | 25 | 50 | 25 | 10 | — |
| 6. | 66 | 50 | — | — | — | 50 |
| 7. | 66 | 66.33 | — | — | — | 33.33 |
| 8. | 80 | 12.50 | 12.50 | — | — | 50 |
| 9. | 60 | 75 | — | — | — | 25 |
| 10. | 80 | 25 | 50 | — | — | 25 |
| 11. | 36 | 60 | — | 20 | — | 20 |
| 12. | 55 | 50 | — | — | 25 | 25 |
| 13. | 53.33 | 33.33 | 33.33 | — | — | 33.33 |
| 14. | 70 | — | 50 | — | — | 50 |
| 15. | 40 | 62.5 | — | 25.0 | — | 12.5 |
| 16. | 85 | 37.5 | 25 | 37.5 | — | — |
| 17. | 37.5 | 50 | — | — | — | 50 |
| 18. | 60 | — | 33.33 | 33.33 | — | 33.33 |
| 19. | 60 | 50 | — | — | 25 | 25 |
| 20. | 55 | 75 | — | — | — | 25 |
| 21. | 37.5 | 25 | 25 | — | 50 | — |
| 22. | 55 | 25 | 50 | — | — | 25 |
| 23. | 23.63 | 77.77 | 11.11 | — | 11.11 | — |
| 24. | 50 | — | — | — | 25 | 75 |
| 25. | 65 | 25 | 25 | — | 50 | — |
| 26. | 50 | — | 25 | 25 | — | 50 |
| 27. | 70 | 50 | — | — | — | 50 |
| 28. | 100 | — | — | — | — | 100 |
| 29. | 100 | — | — | — | — | 100 |
| 30. | 62.5 | — | — | 33.33 | 33.33 | 33.33 |
| 31. | 62.5 | — | — | 50 | 50 | — |
| 32. | 62.5 | — | 33.33 | 33.33 | 33.33 | — |
| 33. | 100 | — | — | — | — | 100 |
| 34. | 62.5 | 33.33 | 33.33 | — | — | 33.33 |
| 35. | 53.33 | 25 | 25 | 25 | 25 | — |
| 36. | 50 | 33.33 | — | — | — | 66.66 |
| 37. | 70 | 33.33 | 33.33 | — | 33.33 | — |
| 38. | 43.3 | 50 | — | — | 25 | 25 |
| 39. | 100 | — | — | — | — | 100 |
| 40. | 100 | — | — | — | — | 100 |
| 41. | 77.50 | — | — | — | 33.33 | 66·33 |
| 42. | 100 | — | — | — | — | 100 |
| 43. | 62 | 20 | — | 20 | 20 | 40 |
| 44. | 75 | — | — | — | 33.33 | 66.66 |
| 45. | 86 | — | — | 33.33 | 33.33 | 33.33 |
| 46. | 91 | — | — | — | 20 | 80 |

were in abundance. All the stands (except in some locations) were unstratified. The species that grow on the lower slopes may be classified into four categories as follows:—

1. The species that grow upon bare rocks and cracks, e.g. unidentified Lichens, *Ephedra gerardiana*, *Capparis spinosa* and *Artemisia vulgaris*. The last two species were also found on the sand dunes.
2. Plants that usually grow in crevices, e.g. *Fraxinus xanthoxyloides*, *Juniperus* sp., *Prunus* sp. and *Rosa webbiana*.
3. The species that require a soil depth of about 2 inch to 6 inch e.g. *Chenopodium* sp., *Alhagi maurourm*, *Salsola kali*, *Amaranthus* sp., *Artemisia scoparia*, *Sonchus* sp. and *Tribulus terrestris*.
4. There is also fourth category of plants that require a soil depth more than 6 inch better moisture condition, e.g. *Tamarix* sp., *Sophora alopecuroides*, *Myricaria germanica*, *Berberis vulgaris* and *Perowskia abrotanoides*.

Crevices obtain their water exclusively from melting snow and local rain. Some crevices contain abundant detritus and are, therefore, endowed with a greater power of storing water while others are poor detritus and allow the water to pass away. The chemical composition of the detritus varies and may have different salt nutrients and minerals in different amounts. Due to these physical and chemical differences, the flora that grows in crevices may be varied.

The vegetation of the dip and scarp slopes also differs considerably. The dip slopes are those where the layers of rocks are inclined (or dipping), while the slopes opposite to the dip slopes are called scarp slopes. The dip slopes are usually very rocky i.e. either their surface is exposed as bare rock (with crevices) or it is covered with rock soil (largely composed of course sand, pebbles, gravels and stones) while the scarp slopes have a soil depth of 1 to 6 or more inches. Moreover, as the latter are usually steeper than the former obviously the plants, that require a fair soil depth for their growth, are more common on the scarp slopes than the dip slopes. It was found that the vegetation is denser on the former than the latter.

The vegetation of some stands is stratified and usually consists of two or three strata. In some localities two strata were due to lichens and herbs, while the scattered shrubs hardly form any stratum. At two stands of Yasin valley, herbs and shrubs form the two strata of the community. The vegetation of Dhamas Valley is stratified into three layers, i.e. herbs, shrubs and trees can be easily recognized. *Juniperus* sp. is very abundant on the higher slopes. The next important species is *Fraxinus xanthoxyloides* which grows abundantly on the lower slopes and narrow valleys. *Rosa webbiana* was also frequent along the river bank and lower slopes. However, the above mentioned three species gradually decrease as we move downhill from Phunder or Gopis to Gilgit.

Although the sampling was restricted to natural or at least semi-natural vegetation, the vegetation of some disturbed areas was also studied. As mentioned earlier, the interference is due to grazing and cutting. Climatic factor, like heavy snowfall, is also a con-

trolling factor, but due to cutting and grazing, a number of obnoxious plants, not characteristic of the area, e.g. *Haloxylon griffithii*, *Amaranthus* sp. *Chenopodium botrys*, *Alhagi maurorum* and *Tibulus terrestris* were present.

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