



A summarizing report on the phytosociological and floristical explorations (1976 – 1997) in Ladakh (India)

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Contents

1.	Introduction	11
2.	Outline map of Ladakh showing the investigation-areas (1–20)	12
3.	Remark on environmental changes	14
4.	Material and Methods	18
5.	Climatic conditions, altitude zonation, Geology and edaphic conditions	19
5. 1	Brief remark on the climatic conditions	19
5. 2	Remark on the altitude zonation	21
5. 3	Remarks on the Geology	22
5. 4	Remarks on soil conditions	24
5. 4. 1	Soil of the subalpine desert (Table 1)	24
5. 4. 2	Soil of the subalpine steppe communities (Table 2)	25
5. 4. 3	Soil of the subalpine turf and steppe-meadow communities (Table 3)	26
5. 4. 4	Soil of steppe and semidesert communities of the alpine belt (Table 4)	26
5. 4. 5	Soil of the <i>Caragana versicolor</i> and the highalpine <i>Artemisia minor</i> – <i>Potentilla pamirica</i> steppe (Table 5)	27
5. 4. 6	Soil of grassland communities of the alpine and highalpine belt (Table 6)	28
6.	The summarizing 6 main Tables in a general view	29
7.	The vegetation summarized in the 6 main Tables	31
7. 1	Vegetation of the subalpine desert in the catchment area of the River Indus (Table 1)	31
7. 2	Subalpine steppe communities (Table 2)	34
7. 3	Subalpine turf and steppe-meadow communities of W Ladakh (Table 3)	39
7. 4	Steppe and semidesert communities of the alpine belt (Table 4)	45
7. 5	<i>Caragana versicolor</i> community and highalpine <i>Artemisia minor</i> – <i>Potentilla pamirica</i> steppe (Table 5)	55
7. 6	Grassland communities of the alpine and highalpine belt (Table 6)	59
8.	Systematic Enumeration of vascular plants collected in Ladakh, 1976–1997	70
8.1	General remarks	70
8.2	List of the vascular plants collected in Ladakh	71
9.	Examples to present a so-called ”vegetation-formula”	118
10.	Alphabetical order of the species listed in the 6 main Tables (with the “vegetation-formulas”)	119
11.	Fotographic illustrations to the summarizing survey	
	Fotos (1–30) with the corresponding numbers of field trip-areas (1–20)	125
12.	References	141

Abstract: This paper presents a report of all explorations on flora and vegetation which were carried out in Ladakh between 1976 and 1997. The study areas stretch from the southern Lachalung La and Zaskar up to the north-facing slopes of the Ladakh-Range and the lower Nubra Valley as well as from the western Dras Valley to the Pangong Tso and the Tso Moriri in the southeast. The difference in altitude between the lowest vegetation relevé in the catchment area of Kargil (2680 m a.s.l.) and the most elevated one near the Taglang La (5317 m a.s.l.) is about 2600 m. All regions of Ladakh in which geobotanical studies were realized are related to 20 “field areas” of different size and shortened with the figures 1 – 20 (Fig. 1). To obtain a general view of the plant communities 6 main Tables arranged on the basis of 343 vegetation relevés are presented. These comprise: 1. Subalpine desert in the catchment area of the River Indus. 2. Subalpine steppe communities. 3. Subalpine turf and steppe-meadow communities. 4. Steppes and semidesert communities of the alpine belt. 5. *Caragana versicolor* community and high alpine *Artemisia minor* – *Potentilla pamirica* steppe. 6. Grassland communities of the alpine and highalpine belt. The 400 in vegetation relevés registered species are listed in alphabetical order. In relation to the vegetation they represent a so-called “vegetation-formula” is used. The latter refers to the main Tables with the corresponding plant communities. In the list of all 615 enumerated taxa remarks are to be found on the cover abundance and the presence degree in corresponding plant communities. Remarks on geology, soil conditions, climate conditions and on the altitude zonation of the vegetation complete the report.

KEY – WORDS: Phytosociology – Plant communities – Floristics – Altitude distribution – Ladakh – Himalaya – India

Zusammenfassung: Der vorliegende Bericht ist eine Zusammenfassung aller zwischen 1976 und 1997 in Ladakh durchgeführten Untersuchungen zur Flora und Vegetation. In der flächenhaften Ausdehnung erstreckt sich das Gebiet vom südlichen Lachalung La und von Zaskar bis auf die N-Seite der Ladakh-Kette ins untere Nubraltal und vom Drastal im Westen bis zum Pangong Tso und Tso Moriri im Südosten. In der Höhengausdehnung liegen die Vegetationsaufnahmeflächen zwischen Kargil (2680 m a.s.l.) und Taglang La (5317 m a.s.l.) ca. 2600 m auseinander. Alle Gebiete Ladakhs, in denen geobotanische Studien durchgeführt wurden, sind 20 in der Grösse sehr unterschiedlichen "Feld-Arealen" zugeteilt, abgekürzt mit den Ziffern 1 – 20 (Fig. 1). Für die Übersicht der Pflanzengesellschaften, zu deren Erfassung insgesamt 343 Vegetationsaufnahmen dienten, werden 6 Haupttabellen präsentiert. Diese umfassen: 1. Subalpine Wüstenvegetation im Einzugsgebiet des Indus Rivers. 2. Subalpine Steppen-Gesellschaften. 3. Subalpine Rasen- und Steppenrasen-Gesellschaften. 4. Steppen und Halbwüsten-Gesellschaften der alpinen Stufe. 5. *Caragana versicolor*-Gesellschaft und hochalpine *Artemisia minor*-*Potentilla pamirica*-Steppe. 6. Rasen-Gesellschaften der alpinen und hochalpinen Stufe. Den 400 in Vegetationsaufnahmen aufgeführten Arten ist – in alphabetischer Reihenfolge – eine sog. "Vegetationsformel" beigelegt, die sich auf die entsprechenden Pflanzengesellschaften der Haupttabellen bezieht. In der Liste aller 615 registrierten und gesammelten Taxa finden sich Angaben zur Artmächtigkeit und Stetigkeit in den entsprechenden Pflanzengesellschaften. Bemerkungen zu Geologie, Bodenverhältnisse, Klimabedingungen und Höhengliederung der Vegetation ergänzen den Bericht.

1. Introduction

During the summer season of 1962 there was an opportunity to visit Baltistan, the northern most district of Pakistan for 4 months, and to conduct botanical studies in the region of the Biafo Glacier in the central Karakorum (25.04. - 23.08.1962). These studies focussed on the investigation of the local flora. However, the main goal was a survey of the predominant plant communities in the alpine and subalpine belt. Results of these first studies were subsequently published (HARTMANN, 1966, 1968 and 1972).

The wish to carry out comparative geobotanical studies in Ladakh, the neighbouring country to the southeast of Pakistan, under Indian sovereignty, could be fulfilled only in 1976. Only after the Indian Government had allowed non-Indians to travel into this country for the first time, did it become feasible to plan such a trip. In summer 1976 the first expedition to Ladakh could finally be realized, but it was connected with the impost set by the Indian Government to join a research group from Dehra Dun belonging to the Botanical Survey of India. This first study tour was followed by 5 more trips in 1979, 1987, 1992, 1995 and 1997. The outline map (Fig. 1) shows places and dates of the trips within Ladakh.

In the course of these 22 years, the opportunity to visit as many different regions of the country as possible had changed profoundly. For military reasons, parts of the country were still closed to foreigners in the first years after the initial opening of the borderline. These included all the areas situated around the border with Pakistan and China, lying to the west, north or to the east of a so-called “inner line” and running in parallel at 1 mile distance north of the road Srinagar - Leh - Upshi. In the first years after 1976, Ladakh could only be reached on this western road. Thus, the most important study areas during this time were therefore the Dras- and Suru Valleys, the valley of Mulbekh, the Indus Valley up to Hemis including Zaskar with the Pensi La. In 1987, the Markha Valley and the old caravan route between Tingsmogang and Liki became accessible too, and to the east excursions could now include Chemre and Sakti. After the outbreak of the conflict in Kashmir, the eastern military road Manali - Leh was opened for tourists and beside the airconnection it quickly became more important for the traffic. In 1992 it was possible to work on both sides of the Taglang La. In 1995 though, it had become possible to visit the Ladakh Range on both sides of the Khardung La and to continue the trip on its northern side up to the Shyok- and Nubra Valley. In the south, the path across the Taglang La to the Tso Kar and the southern most areas of Rupshu was now open. In 1997 the valleys of Darbuk and Muglib were finally reached over the Chang La. A special permit even allowed a short visit to the desert landscape at the N-end of the Pangong Tso. In the SE we could follow the Indus Valley up to Mahe and continue from there towards the south across the Kiagar La up to Karzok at the Tso Moriri.

Since the results of the geobotanical studies have appeared between 1983 and 1999 in the form of six publications, the aim of the current work is to give a summarizing report on the main results in an abbreviated form. More detailed information on the geographically quite distinct areas, detailed descriptions of the travelling routes, climate and utilization, about the different plant communities, exact localities of the filed studies, life form-spectra, geology and soil conditions can only be found in the original papers. Each of the original papers contains a geographical sketch on further details of the different districts.

The significance of the different growth- and life forms has been stressed several times in the earlier papers, in great detail in the work published 1995. Life form-spectra of the different communities can be found in the papers of 1983, 1987, 1990, 1995 and 1997. In the present work the life form-classes according to Raunkiaer have been added to each taxon in the “List of vascular plants” (8. 2).

As repeatedly emphasized, the often sparse plant cover outside of the populated areas is exposed to significant pressure by grazing domestic animals. Rupshu, the region situated at least 4500 m above sea level to the S and to the SE of the Taglang La (5315 m), is of special interest as this area contains almost no permanently inhabited settlements. At least up to the time of the field work in 1995 and 1997 only nomads with herds of goats and yaks had been visiting this region.

Ladakh belongs to the central-asiatic dryland. It includes a cultivated area of only about 160 km², which accounts for about ¼% of its total area. The cultivation of cereals, buckwheat, vegetables and fruits is only possible on irrigated land. Therefore, each settlement throughout the country is to be considered as an oasis. The precipitation rate is lowest at the subalpine belt of the Indus Valley and in the easternmost parts of the country starting at the Pangong Tso up to the Tso Moriri.

Since throughout the present work the seven original papers (1983 – 1999) are repeatedly mentioned, the name of the author is left out in most cases. A year given in brackets without a name (1995) therefore signifies „HARTMANN (1995). Beitrag zur Kenntnis der subalpinen Wüsten-Vegetation im Einzugsgebiet des Indus von Ladakh (Indien). Candollea 50: 367 – 410“. A comprehensive review of the recent literature has not been included in the present paper, as the main emphasis lies on the review of the results of the author's own investigations in Ladakh.

Acknowledgment

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2. Outline map of Ladakh showing the investigation-areas 1–20

(see Fig. 1)

All regions within Ladakh where geobotanical studies have been realized are linked to 20 main areas differing significantly in size. These have been assigned the numbers **1–20**. Position and approximate size of these

study areas are represented in the survey map (Fig. 1) and the following list. Since in some places it is difficult to draw clear borders between adjoining field areas (e.g. Rizong: 9 / 10; top of Taglang La: 15 / 16), in these cases both the corresponding numbers are given.

La = pass

Tso = lake

- | | | |
|---|---|-----------------------------|
| <u>1</u> Zoji La | <u>2</u> Dras Valley | <u>3</u> Kargil Area |
| <u>4</u> Suru Area | <u>a</u> Primary Valley from South to North (S – N)
<u>b</u> Valley east (E) of Kartse
<u>c</u> Valley of Chellong River
<u>d</u> East(E) – West(W)- part in the South (S), Sanmodangsa (Gulmatungo) | |
| <u>5</u> Area of Pensi La | <u>6</u> Zaskar (Tungri, Dzongkhul, Padum, Bardan etc.) | |
| <u>7</u> | <u>a</u> Area W of Mulbekh up to Namika La
<u>b</u> Valley SE of Mulbekh, Gel (Wakha Chu) | |
| <u>8</u> | <u>a</u> Area of Fotu La <u>b</u> Area S of Khalsi up to Lamayuru
<u>b</u> Area S of Khalsi up to Lamayuru | |
| <u>9</u> Gorge of River Indus (Khalsi – Alchi / Saspul) including Alchi Brok (Lardo Brok) | | |
| <u>10</u> Old Kashmir – Route N of River Indus (Tingsmogang – Ang – Hemis Shukpachan – Charatse La – Yangtang – Likir) | | |
| <u>11</u> Indus Valley between Ronga La and W of Leh (incl. Nie, Umla, Ladakh Konka, Zinchen, Phiyang) | | |
| <u>12</u> Indus Valley (right side): Area of Leh, South Pulla, Khardung La (S), Sabu, Tikse, Nang, Chemre, Sakti, Zingrul, Chang La (S) etc. | | |
| <u>13</u> Indus Valley (left side): Stok (--Phu), Matho (--Phu), Area of Hemis, Rumbak, Yurutse, Kanda La (N), N of Kongmaru La, Shang etc. | | |
| <u>14</u> Markha Valley: Kanda La (S), Skiu, Markha, Tchatchutse, Nimaling, Kongmaru La (S) | | |
| <u>15</u> Miru – Lato – Runtse – Taglang La (N) | | |
| <u>16</u> Taglang La (S) – Rupshu (Debring, Tso Kar, Norbo, Pang, Lachalung La) | | |

17 Indus Valley E of Upshi: Hemya – Mahe – Sumdo – Kiagar La

18 Area of Kiagar Tso – Tso Moriri – Area of Karzok

19 Khardung La (N) – Khardung - Valley of Shyok River – Valley of Nubra up to Panamik

20 Chang La (N) – Tsoltak – Darbuk – Muglib – Pangong Tso

Remarks on more recent taxonomic modifications (see 8.2 list of vascular plants)

For various reasons it was not possible to include all recent changes in taxonomic assignments, most of which were proposed after the actual field work had been done. Some key indications I owe to BERNHARD DICKORE and his 'Flora Tibetica' database. According to him for example the combination *Ajania* (*Tanacetum*) *artemisioides* does not exist. Neither does the genus *Chrysanthemum occur* ('*Chrysanthemum tibeticum*' = *Tanacetum stoliczkae*).

Most samples of *Krascheninnikovia* refer to *K. pungens* (Pazij) Podlech. In the high altitudes of the east one might also expect *K. compacta* (= *Eurotia compacta* A. Los.; see also Table 5 with *Caragana versicolor* – community and the *Artemisia minor* – *Potentilla pamirica*- steppe in between 4750 and 5200 m a.s.l.).

In the case of the juniper stands from the Wakha-Valley and from Hemis Shukpachan the actual species assignment is *Juniperus semiglobosa* Regel.

'*Potentilla sericea*', which is very important for the development of the vegetation at high altitudes, refers to the species now designated as *P. pamirica* Wolf.

In order not to interfere with the consistency and readability of the Tables, I may have waited longer than usual with the adoption of proposed new species assignments. Yet, well founded name changes may easily be integrated without major efforts at a later stage.

DICKORÉ (1991) has shown for the northern slopes of the Karakorum and the Kunlun Shan, that solely based on single characteristic species a description of the altitude- and vegetation zones is possible starting from the colline up to the subnival level and over a distance of 200 km. Based on floristic observations, he was able to make a distinction of the vegetation levels starting from the extremely arid lowland at the edge of the Takla Makan (1300 m) up to the altitude of 5200 mNN, close to the northern slope of the K2.

3. Remark on environmental changes

Hemis Shukpachan, along the "old cashmir – route" between Ang and the area to the south of Likir, is marked by a stock of junipers (*Juniperus smiglobosa*, picture nr.13) which might be unique for Ladakh. With the exception of the willow-poplar-stands along the river shores and plantations next to populated areas, there are no forests in Ladakh. The said location with its stand of *Juniperus* of at least 100 trees has long been

known in the literature. It can be assumed that the place has even got its name from these up to 10 meter tall and occasionally 1 meter thick trunks of *Juniperus*. SCHWEINFURTH (1957), referring to previous authors, writes of “enormous specimens of *Cedrus deodara* and *Juniperus excelsa*...”, but he adds that PAMPANINI (1930) in his ‘Flora of the Karakorum’ only lists *Juniperus* and not *Cedrus deodara*. Oral tradition also speaks of a “forest of cedars”. However, the lack of true cedar trees is explained by PAMPANINI with the fact, that this place is not a natural habitat of this species. *Cedrus deodara* is often planted in the western Himalaya near sacred places, but most likely cedar trees have never grown here. The locals call the juniper “sukpa”, “shukpa” or “shupa”, which means cedar. In English *Juniperus semiglobosa* is called “Himalayan Pencil Cedar” or simply “Pencil Cedar”. However, the true Himalaya-cedar, known as “Deodar”, can owing to ecological reasons hardly be expected at this place i.e. at around 3700 m altitude and at the edge of the desert.

Juniperus semiglobosa is the most important representative of the genus in the dry zones beyond the Himalaya. In Ladakh it is less abundant than in the Karakorum in Pakistan. Today true juniper stands are hardly found in Ladakh, a fact which may be attributed to human intervention. I have seen stands of juniper shrubs only on slopes in remote and in side valleys accessible with difficulty, for example in the ravine-like Wakha-valley. In the lowest part of this valley, which is a true peculiarity, some specimens of real juniper trees are found. Some strongly withered trunks indicate that earlier on more trees must have also grown there! The lowest of these trees grows facing Gel (**7 b**) on the left bank of the river, about 3350 mNN; 1,5 m above the ground its diameter in 1979 was around 1,2 m and its height was estimated to be 12 m (1984, Picture 8). The question whether these *Juniperus*-stands are witnesses of former steppe forests cannot be answered clearly.

Since the pollen analysis of BHATTACHARYYA (1989) at the Tso Kar (Rupshu, 4600 m, **16**), we have an approximate idea of the climate and the vegetation in the region for the last 30'000 years. This analysis reveals the continuation of the alpine steppe with four periods of expansion of *Juniperus* communities during 28'000 – 30'000 years B.P., 21'000 – 18'375 years B.P., slightly before 15'800 years B.P. and around 10'000 years B.P. These phases of *Juniperus* expansion were interpreted as events of amelioration of the climate within the alpine steppe during the later part of the last glaciation in the alpine Trans-Himalayan region. The climatic ameliorations in Ladakh were possibly associated with higher precipitation rates and higher temperatures as compared with the present conditions.

The unique *Juniperus*-stand of Hemis Shukpachan was visited twice: on 21. 07. 87 and on 2. 09. 97. As complete species inventories are lacking, clear changes within these ten years can hardly be recognized. Some of the trees had died or were dying on the second visit. Also the still vital specimens appeared less dense as compared to ten years earlier. Below the *Juniperus*-trees, humid to wet turfs dominated by *Carex pseudofetida* grow. Frequent accompanying species are: *Leontopodium monocephalum*, *Gentiana moorcroftiana*, *G. leucomelaena*, *G. falcata*, *Kobresia royleana*, *Euphrasia* cf. *kashmiriana*, *Ranunculus tricuspidis*, *Lomatogonium carinthiacum* and *Pedicularis longiflora* var. *tubiformis*, at stony sites *Lonicera spinosa*. Most species can hardly be recognized due to the grazing activities of animals.

In the first half of September 1997 we had – as already two years before – the impression, that the vegetation of the desert had been growing denser as compared to five years before. This is particularly true for terrain depressions and furrows but partly also for flat areas. Already in 1995, it was striking, that in the ravine between Upshi – Miru – Lato the slopes had become greener as compared to in earlier visits! Similar trends were noted around Leh, in the neighbouring side valleys and at the Ladakh Konka in the Indus Valley. To the west and east of these wide plains, but also much farther to the west at the Ronga La, wide areas were populated by *Nepeta floccosa*. From a distance such desert areas appeared as lilac fields. Measuring coverage in these areas today might yield even 5% higher values. The most likely cause for these vegetation changes is more frequent rainfall during the main vegetation period.

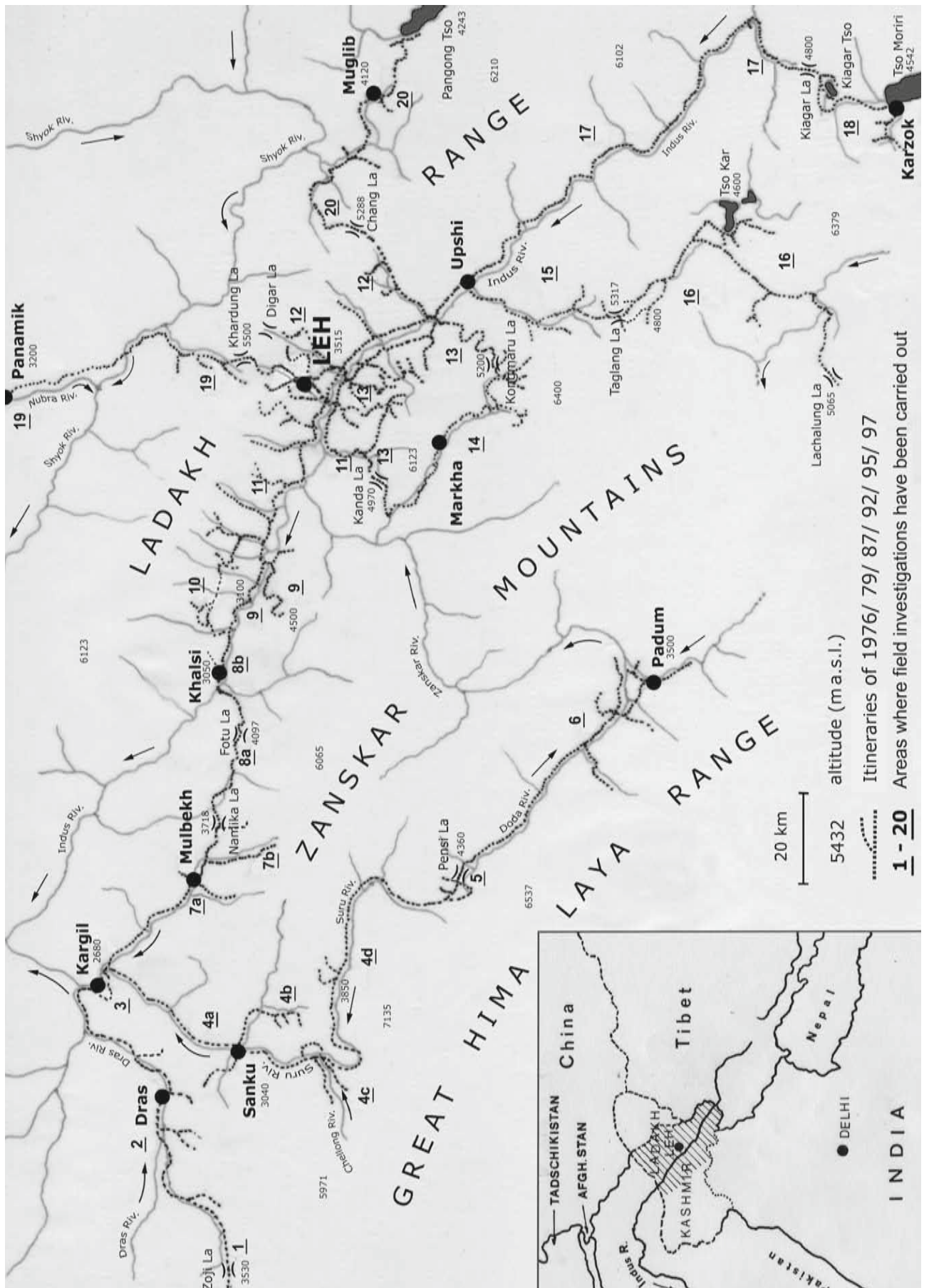


Fig. 1: Geographical map of Ladakh

4. Material and Methods

In the course of the field work for all relevés taken out in Ladakh the same method was used (J. BRAUN-BLANQUET, 1964). In the field 343 vegetation relevés, as homogenous areas as possible of 100 or 150 m² were selected. In rare cases the size of the square or rectangular sample plots was 80 or 50 m², e.g. in grassland communities with a denser cover. The present species were estimated in relation to the cover abundance (combined determination of abundance and cover value) according to the known seven-part scale:

5 = covering more than $\frac{3}{4}$ of the area	2 = very numerous, or covering $\frac{1}{20}$ – $\frac{1}{4}$ of the area
4 = covering $\frac{1}{2}$ – $\frac{3}{4}$ of the area, any number of individuals	1 = plentiful but of small cover value
3 = covering $\frac{1}{4}$ – $\frac{1}{2}$ of the area, any number of individuals	+ = sparsely, cover very small
	r = very sparsely, (usually only one individuum)

Only for the single relevés, these values are directly included in the six Tables (e.g. in Table 2 for nr. 2 and the numbers 9 – 13). However, the majority of the relevés is listed in Tables of communities, subassociations, variants and first of all in Tables of community-groups. In these “original” Tables for each taxon the presence degree and following from this the class of presence degree has been determined, and these summarizing data are included in the main Tables in this work. If vegetation types cannot be assigned to well defined associations, the name “community” will be preferred! Generally, we choose not to distinguish clearly between alliances, orders and classes. Instead, similar or corresponding communities are summarized on occasion in community-groups. The classes of presence degree are represented by roman numerals which (given as percentage) indicate the following:

V > 80 – 100 %	II > 20 – 40 %
IV > 60 – 80 %	I > 10 – 20 %
III > 40 – 60 %	+ > 5 – 10 %
	r > 0 – 5 %

To the values of the class of presence degree in the main Tables, the range of the cover-abundance in small superscript letters has been added. Cover abundance values in bold in the Tables 1 – 6 indicate species which either had only been found in the corresponding communities or association-groups or which have there preference in the corresponding vegetation units. The Tables of the original publications (1983-1999) are abbreviated with “Tab. Nr. (1990), (1995)”etc.

In total, far over 200 soil samples were collected, which then were assessed mainly for the pH-value and the carbonate content. The electrochemical pH-records were taken in a soil suspension made up in 0.1-m KCl-solution. Presence / absence of a carbonate content was determined with diluted hydrochloric acid (HCl).

5. Climatic conditions, altitude zonation, Geology and edaphic conditions

5.1 Brief remark on the climatic conditions

The significance of the Himalaya-Range as a climatic border-line between the central asiatic dryland, to which Ladakh belongs to a large extent, and the moister southern slopes of the Himalaya has already been emphasized in the first publication on the plant communities of Ladakh (1983).

Information with diagrams (Fig. 2) on the climate of Sonamarg (2580 m¹⁾ / 1810 mm³⁾), Dras (3066 m¹⁾ / 2.0°²⁾ / 757 mm³⁾), Kargil (2682 m / 8.9° / 306 mm) and Leh (3514 m / 5.5° / 115 mm) show the change in climatic conditions which can be expected along the so-called “Route of Kashmir” (coming from Srinagar) over the Himalaya main Range up to the Indus Valley. The dramatic drop in precipitation rate between Sonamarg and the hardly 45 km to the northeast located Dras is especially surprising as the even 500 m higher situated Dras does by far not receive half of the average annual precipitation of Sonamarg. By a simple comparison of the figures mentioned above, it can clearly be recognized that the dryness is continually increasing towards the north, and similarly also towards the east. In parallel, the plant cover becomes more and more scanty. The landscape in the subalpine belt is becoming increasingly dominated by steppe vegetation and in the Indus Valley it finally is dominated by desert vegetation in the true sense of the term.

Looking at the annual distribution of the precipitation rate in Sonamarg situated south of the Himalaya main Range it becomes obvious that this region of Kashmir receives its precipitations mainly during the winter and spring, and to a significant extent in the form of snow. Nevertheless, summer is not dry at all in this area, for even in the driest two summer months more rain falls than for example in Leh during the whole year!

Winter temperature at Leh does not drop as low as in the western Dras Valley despite the higher altitude. On the other hand the dry season is twice as long in the region of Leh, namely about 8 months. As a consequence, beyond the irrigated fields, only desert-communities are formed.

The gradual change in climate with an increasing dryness in the alpine belt from NW to SE upwards along the River Indus is reflected in the climate figures for Skardu (2300 m / 10.8° / 164 mm), Leh 3514 m / 5.5° / 115 mm) and Gar (4232 m / 0.7° / 54 mm) shown in HARTMANN (1997). For example the 1200 m lower and about 220 km NW of Leh situated Skardu (Pakistan) is surrounded by desert-like vegetation. On the average, 50 cm more annual precipitation is recorded here, which in contrast to Leh, falls mainly in winter and spring, even if this phenomenon is not as much pronounced here as in Dras and Kargil. Only half the annual precipitation rate of Leh is recorded at the station Gar in western Tibet, situated further 700 m higher, but more than 300 km to the SE of Leh. The very scarce precipitation is focused here even more in the summer season, but the average annual temperature is only slightly above freezing point.

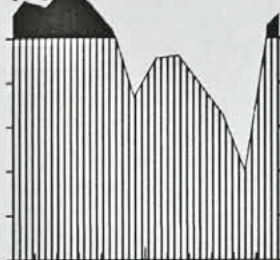
1) Altitude in m a.s.l.

2) Mean annual temperature

3) Mean annual precipitation

Sonamarg

(2580m) 1810
[40]

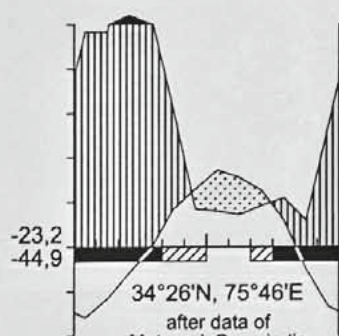


34°18'N, 75°18'E

after data of
Meteorol. Serv. India

Dras

(3066m) 1,8° 651
[1908 - 48]

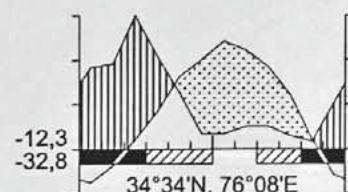


34°26'N, 75°46'E

after data of
Meteorol. Serv. India

Kargil

(2682m) 8,9° 266
[1908 - 47]

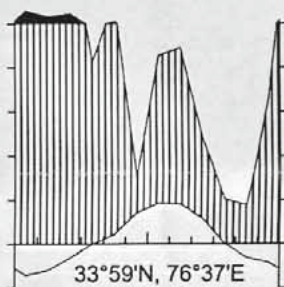


34°34'N, 76°08'E

after data of
Meteorol. Serv. India

Matsal

(4325m) 0,9° 982
[1971 - 80]

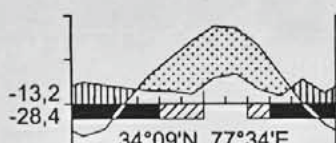


33°59'N, 76°37'E

after data of
Meteorol. Serv. India

Leh

(3500m) 5,7° 83
[60]

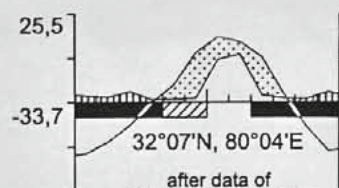


34°09'N, 77°34'E

after data of
Meteorol. Serv. India

Garyarsa / Gar Yersa

(4232m) 0,7° 54



32°07'N, 80°04'E

after data of
Meteorol. Serv. China

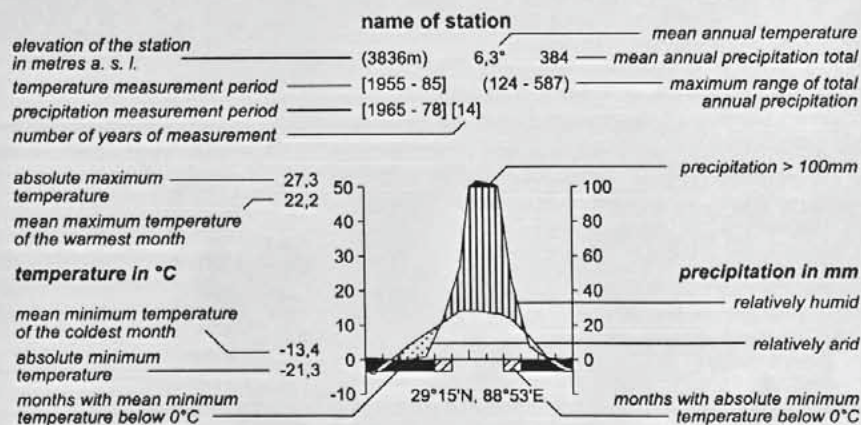


Fig. 2: Climatic diagrams S and N of the Great Himalaya Range

5.2 Remark on the altitude zonation

The vertically discernible altitude and vegetation belts are found at higher altitudes when going towards the northeast and east. Whereas the climatic snowline in the far western Ladakh, at the Zoji La according to H. v. WISSMANN (1961) lies at 4600 – 4800 m above sea-level, it is in the region of Taglang La – Rupshu about 1000 m higher. For the succession of the vegetation belts in the inverse direction, a less steep descent has to be assumed. While the important borderline subalpine / alpine reaches at the Zoji La with the last birch trees an altitude of 3500 – 3600 m, it is to be assumed in the east, e.g. at the N-slopes of the Taglang La, between 4300 and 4500 m a.s.l.

In the forest-free mountain areas the corresponding borderline can indirectly be proven where comparisons are possible with plant communities – e.g. grassland-communities –, which elsewhere can be characteristic at the timberline. Where such comparisons are impossible, the transition subalpine / alpine can be described with a change of the steppe vegetation. For example the typical *Artemisia* – steppe is often replaced by “alpine” steppe communities, which have their main area of distribution in higher altitudes. Often, such borderlines between different patterns of vegetation are visible at a large distance by the more intense green coloration (with increasing altitude). Such a change with increasing altitude coincides on the one hand with a vegetation becoming denser and has a higher plant cover-index. On the other hand there is a change in the species combination. In western, central and near-eastern parts of the country the richness in species also rises with the altitude up to the alpine belt. These are mainly consequences of the higher precipitation rate with increasing altitude. At higher altitudes there is not only more often rainfall, but a consequence of the melting water, which is active for a longer period, the soil remains moist for a longer period.

In Rupshu (S and SE of Taglang La) and north to the Ladakh Range such changes in the vegetation become more and more unclear towards the east to finally being completely lost e.g. at the Pangong Tso and in the catchment area of the Tso Moriri (especially in the eastern direction). Those eastern areas are therefore characterized up to the limit of plant life by mountain desert. Further additions on the question “subalpine-alpine borderline” can be found in HARTMANN (1995, p. 372).

DICKORÉ (1991) has shown for the northern slopes of the Karakorum and the Kunlun Shan, that solely based on single characteristic species a description of the altitude- and vegetation zones is possible starting from the colline up to the subnival level and over a distance of 200 km. Based on floristic observations, he was able to make a distinction of the vegetation levels starting from the extremely arid lowland at the edge of the Takla Makan (1300 m) up to the altitude of 5200 mNN, close to the northern slope of the K2.

5.3 Remarks on the Geology

(the figures in brackets represent areas of field investigations 1 – 20)

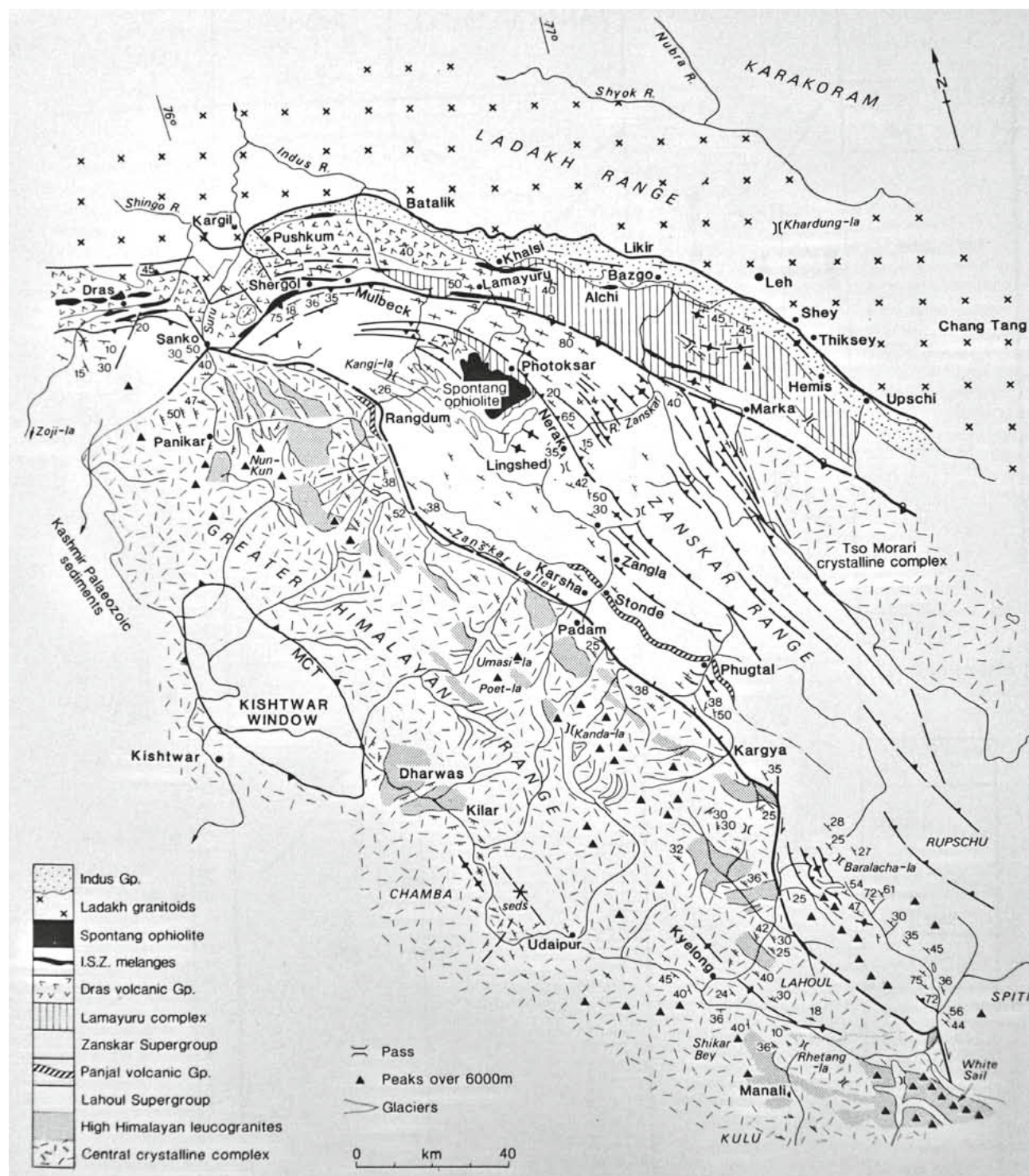


Fig. 3: Geological map of Ladakh between the Great Himalaya Range and the Karakorum (after Searle, 1991)

In the middle and southern localities of the Dras Valley, where geobotanical studies have been conducted, ophiolitic rocks of the Nindam-Dras Formation, clay-shales of the Lamayuru Formation and of the Neothetyan Shelf form the rocky subsoil (2). In the close surroundings of Kargil (3) the subsoil is made up from granitic rocks of the Ladakh Intrusive.

In the Suru Valley, from Sanku, Panikhar going by Gulmatungo or Sanmodangsa (4) to the Pensi La (5) up to Zaskar (6) there are predominantly precambrian metamorphic rocks involved in soil development, i.e. different gneisses and sericite schists, which in the form of detritus form the C-horizon. Greenish-black amphibolite-like rocks were found in certain areas in Zaskar only.

The region of Mulbekh and to the east up to Lamayuru is part of the Lamayuru Formation with its grey and dark silts (7, 8). Khalsi and the regions to the east along the River Indus include sediments of the Indus Molasse (8 b, 9). Side valleys of the Ladakh Range, which empty into the Indus from the NE, run through the granitic rocks of the Ladakh Intrusives (11, 12). The catchment of Leh, especially in the W, N and SE direction is part of this formation.

In the form of the so-called Indus-Sutur-Zone, the southern boundaries of the Ladakh Range (approximately following the River Indus) geologically mark the collision between the Indian and the Eurasian continents, which took place at the beginning of the tertiary (around 60 million years ago). Parts of the oceanic crust which have been raised during the collision, including deep-sea sediments, characterize this significant borderline as Ophiolites and Volcanics.

North of the Ladakh Range, the region of Khardung is characterized by Volcanics and in the lower Nubra Valley granites of the “Karakoram Batholith” (19) form at least the left (eastern) side of the valley (SRIMAL & al. in SEARLE, 1991). To the N and to the E of the Chang La, the valleys of Tangtse and Muglib up to the Pangong Tso (20) lie predominantly within the “Pangong metamorphic complex” (SEARLE, 1991).

At the SW edge of the Ladakh Range, the flow direction is given by the tectonic conditions. On the Ladakh-granite lie (approximately following the course of the river) thick layers of Molasse, with a foliation towards the SW. In the section of the lower Ladakh, the Indus-Molasse reaches several kilometers beyond the River Indus towards the NE. Along the contact zone with the Ladakh-granite, the old caravan route, the so-called “upper path”, runs from Kashmir to Leh (10). For further details see (1995).

In the upper Ladakh, the Indus-Molasse (Eocene – Miocene) can predominantly be seen on the left side of the valley in the form of marked stratifications. The changing sediment series present a rich palette of different Molasse-stones: grey and greenish sandstones are followed by red, green and dark-coloured shales of differing hardness. Even colourful conglomerates, sandstones and marl-like layers can be found (13, 15).

In the region of Matho Phu (13), red and greenish sandstones are most frequent, followed by conglomerates. More rarely, red and green shales form the subsoil. From Stok Phu over the Stok La, by Yurutse and up to the Kanda La (13), the subsoil is mainly formed by shales of dark-brown to bright-grey colour as well as by sandstones.

In the Markha Valley up to Nimaling, mainly mesozoic sediments of the Lamayuru Formation contribute to the subsoil (14). These form also the subsoil at the left side of the valley of Nimaling. On the top of these, permian slates are found. At the right side of the valley in the direction of the Kongmaru La these belong to the “multicoloured stones and Jurutze Flysch of Indus Molasse”.

Whereas between Rumtse and Tsakenama at the N side of the Taglang La (15) different mesozoic sediments of the Lamayuru Formation form the subsoil, further to the S over the Taglang La to the Tso Kar a multitude of sediments and metamorphic rocks of precambrian – palaeozoic age follow. In the plain of Debring towards the SE in the basin of the Tso Kar and towards the S over the More Plain quaternary deposits form the substrate for soil development (16).

The most eastern areas, to the south of the Indus River, from the Kiagar La over the Kiagar Tso to the Tso Moriri, belong to the Gneiss-Complex of the Tso Moriri-Nappe (17, 18). A good outline over the geological conditions in the NW Himalaya of India is given in the map of A. STECK (2003). This map includes a large part of Ladakh in northern direction up to the Ladakh Range.

Of significance for the soil development is the fact that soil forming rocks are present in most cases in form of detritus or sand and that therefore the bedrock geologically need not be identical with the C-horizon of the soil profile. Depending on its mode of development, the detritus is mostly colluvial, in some cases alluvial or sometimes deposited by wind as sand.

Fig. 3 Geological map of Ladakh between Great Himalaya Range and Karakorum
(after Searle, 1991)

5. 4 Remarks on soil conditions

5. 4. 1 Soil of the subalpine desert (Table 1)

The substrate for the desert vegetation at the subalpine belt is exclusively made up of raw soils (without humus top layer) which come close to a Yermosol, Xerosol (SCHEFFER / SCHACHTSCHABEL, 1992) or the grey semi-desert soils in the sense of GANSSSEN (1968). Differences in the grain-size, in the content of fine soil, in compactness and in the composition from different rock qualities do not have a significant influence on the composition of the plant communities. Humus layers in the true sense are usually not detectable. From real

stony soil up to a pure sandy soil, everything is possible. Obviously, the pronounced scarcity of water is the dominating factor outweighing all other ecological differences!

In all soil samples an unequivocal carbonate reaction with diluted HCl was observed. Accordingly, the pH-values (in a solution of 0.1-m KCl) determined at 33 different sites lay all within the range of 7.2 – 8.0. Noteworthy is the fact that all the values lie within this range regardless of the subsoil (sandstone, slates, granite). Reactions, which have been summarized under the term “calcification” (s. e.g. HARTMANN, 1995) are responsible for this effect.

5. 4. 2 Soil of the subalpine steppe communities (Table 2)

In the soils of the first 5 relevés of nr. 1 on detritus formed from shales, especially from amphibolites, no carbonate has been detected, whereas in the samples of the remaining 7 relevés the carbonate reaction was very pronounced.

The loose but also the very compact detritus may contain conglomerates. The fine soil contains significant amounts of dust. In the 17 soil samples from nr. 1 and nr. 3 pH-values between 4.9 and 8.2 have been recorded.

In the 21 stands of nr. 4 and nr. 6 compact detritus soils made up from gneisses, sericite or schists of micaschist form the C-horizon. The often ± ochre-coloured fine soil has a dusty-silty to sandy grain-size. Exceptionally, the fine soil is up to 40 cm thick, free of stones and in the top 5 – 10 cm of a blackish brown colour. In nr. 4, nine samples had pH-values of 4.8 to 6.6, in nr. 6 (5 samples) 5.4 to 6.2.

The 15 sampling plots of the desert-steppe of nr. 5 – from Umla to Sakti and Khardung on the N- facing slopes of the Ladakh Range – have a subsoil of granitic rocks. At all sites, the granite is present as detritus, mostly well compressed. The bright- to ochre-coloured fine soil is ± rich in silt, with fine sand and stones. Samples from nine stands showed pH-values of 7.2 to 8.3. With two exceptions the carbonate reaction was positive.

Gneisses and slates of micaschist form the coarse rock debris of the 12 stands of nr. 7 in the Suru Valley (4) and Zanskar (6). In 6 samples of the silty-sandy fine soil a pH between 5.1 and 6.5 was recorded.

The 8 relevés of coarse rock debris-communities with *Stachys tibetica* (nr. 8 and nr. 9) originate from rather different areas. The rubble made up from sandstone, shales and gneisses reaches the soil surface. Debrisic–sandy fine soil between the individual rocks yielded at 3 sites pH-values of 6.4, 7.3 and 8.0.

5. 4. 3 Soil of the subalpine turf and steppe-meadow communities (Table 3)

A significantly deeper reaching, up to 50 cm thick fine soil layer which is almost free of stones and rich in silt is characteristic of the sites of nr. 1 in the southern Dras Valley (2). The weak enrichment in humus components in the uppermost 5 cm is distinct. Four pH-samples stated for nr. 1 and 2 lay between 5.3 and 6. Around 40 km to the NE in the Dras Valley, but at comparable altitude the soil is less deep and more stony(s. nr. 3), but the pH-values are the same.

The soil of a community-group with *Bistorta affinis* (nr. 4 and 5) in the Suru Valley (4 b and 4 c) is deeper reaching and richer in humus components when compared to the neighboring steppe. Nevertheless, the development of distinct soil horizons is barely visible. The pH-values of four samples vary between 5.5 and 6.1.

Coarse rock debris made up from gneisses is predominantly forming the rocky subsoil of the relevés nr. 6. The share of silty-sandy fractions and gravel between the bigger rocks varies. Three recorded pH-values are: 5.3, 5.4 and 6.4.

The 10 relevés of nr. 7-9 are limited to the uppermost part of the Suru Valley directly to the north of the Himalaya main Range (4 d). Debris made up from gneisses forms here the subsoil, covered by a fine soil layer of strongly varying depth. In the bottom of the valley, over 1 m thick deposits of sand and silt form the root horizon. pH-values in four samples varied from 4.8 to 5.3.

The three relevés of densely covered *Carex melanantha*-meadows (nr. 10) were recorded in a northern side valley of the upper Suru River (4 d) near the border to the alpine belt. The relatively deep reaching soil on debris of gneisses has a brown-soil like composition. The fine soil with few or no stones gave a fresh and moist impression. pH-values in the depth of 5 cm and 20 cm are 4.4 and 4.1.

5. 4. 4 Soil of steppe and semidesert communities of the alpine belt (Table 4)

The soils of the six relevés of nr. 1 and 2 in the Indus Valley (9) consist of \pm well consolidated detritus made up predominantly from shales, but also from conglomerate and sandstone of the Indus Molasse. Samples taken on 5 stands in the area of Lardo gave pH's of 6.6 to 7.3.

In the soil of the 10 relevés of nr. 3 (community with *Acantholimon lycopodioides*) on Matho Phu (13) mainly red but also greenish slates, as well as sandstones and conglomerates are involved. In soil samples taken at three sites pH's of 6.3, 6.4 and 6.8 were recorded.

Significantly less species are found in the community nr. 4 with *Artemisia gmelinii* from the area of the Kanda La (13). Here grey and light brown shales and sandstones make up the subsoil in form of detritus. Samples from three sites gave a pH of 7.1 and twice 7.5.

With the 9 relevés of nr. 5 from the area of Stok Phu going over the Stok La in the direction of Rumbak (13), a species-poor community is described, which populates steep screeslopes of the higher alpine belt. The detritus formed from different coloured shales and sandstone at four stands gave a pH between 6.7 and 7.5.

Well settled detritus soil from gneisses, granite and slates containing a lot of silty and sandy fine soil in the far end of the Marka Valley (14) is typical of the alpine steppe of nr. 6. Three pH-determinations are 7.4 and twice 7.5.

The nine sample plots of nr. 7 to the north of the Taglang La (15) and the 14 relevés of nr. 8 in the S and SE of the pass (16) lay in the alpine desert-steppe with *Krascheninnikovia pungens* and / or *Ptilotrichum canescens*. For the dry soil of the mountains in most cases the soil forming rocks were present in the form of detritus. In the plains, it can also be in form of sand and in rarer cases in form of gravel. The most sand- and silt rich soils are found in flat areas or next to the bottom of slopes. Four pH-values of nr. 7 lay between 7.6 and 7.9. In 8 samples of nr. 8 the values vary between 7.2 and 8.1.

The subsoil (C-horizon) of the 12 sample plots of nr. 9 from the alpine steppe on both sides of the Khardung La and the Chang La (12, 19, 20) is almost entirely made up of well settled granite detritus. In samples from 8 stands the pH vary between 6.1 and 8.2.

Regardless of the fact that the soils are formed from granite detritus, the carbonate reaction in the 9 relevés from the mountain desert (nr. 10) on the N side of the Chang La up to the Pangong Tso (20) and at the Tso Moriri (18) is positive everywhere. At six sites pH-values between 7.8 and 8.2 were recorded.

From the surroundings of the Kiagar Tso (18) and from the Kiagar La (17) originate the 7 relevés of nr. 11 of the alpine steppe with *Stipa purpurea* and / or *Carex moorcroftii*. Soil forming rocks for these dry soils are gneisses and slates of micaschist. The root horizon, which in most cases is very rich in fine sand, is normally also rich in stones. At two sites, pH samples of 6.2 and 7.6 were recorded.

5. 4. 5 Soil of the *Caragana versicolor* and the highalpine *Artemisia minor* – *Potentilla pamirica* steppe (Table 5)

Three relevés of nr. 1 represent the high alpine steppe from the area to the north of the Taglang La (15). Significant differences to the soils of the desert-steppe are hardly recognizeable. In accordance, the recorded pH-values of three sampling plots are practically unchanged: 7.6, 7.7 and 7.9. In all samples there was a distinct carbonate reaction.

The dwarfshrub community of *Caragana versicolor* to the north and to the south of the Taglang La (15, 16) is represented by the nine relevés of nr. 2. This soil too can hardly be distinguished from the desert-steppe. Only below the *Caragana* shrubs there is an indication of some humic matter. Three samples showed pH-values of

7.5, 7.9 and 8.3, and a carbonate content is present throughout the samples. Detrital rocks from grey, red and brown shales, sandstone and some conglomerate form the subsoil of the 7 relevés of nr. 3 on Matho Phu and at the Kanda La (13). The uppermost soil horizon of 5 to 10 cm is generally enriched with decayed litter of *Caragana* and therefore coloured slightly darker. Two samples gave the following pH: Matho Phu 7.0, Kanda La 7.1.

Similar soil conditions are found at the high valley of Nimaling (14), where the low dwarf shrub dominates the vegetation of the right side of the valley up to 4900 m a.s.l. The pH-value in one of the two sample plots (s. nr. 4) was 7.1.

From the region in the SE of the study area originates the relevé of nr. 5, about 8 – 10 km to the W above Karzok (18). At a depth of 10 cm in the almost stone free fine soil of the root horizon (above slates of micaschist with quartzite) a pH of 5.9 was determined.

5. 4. 6 Soil of grassland communities of the alpine and highalpine belt (Table 6)

With the 12 relevés of nr. 1 the grassland of *Kobresia schoenoides* at the Pensi La is presented (5). At the half of the sample sites (variante I in Table 3, 1990), the more deep reaching fine soil gave a moist impression up or almost up to the surface. In 12 soil samples a pH between 3.8 and 5.7 was recorded. Only at one site at pH 7.0 a very weak carbonate reaction was observed.

On steeper slopes ($> 15^\circ$) at the Pensi La, there is the community of nr. 2 which grows on the detrital stones formed from the same gneisses (see 5. 3). Soil samples were taken from all eight stands. The determined pH-values were in the range of 4.2 to 7.4.

In the narrow and wider surroundings of the Taglang La (15, 16), the turf of the community-group with *Poa attenuata* and *Potentilla pamirica* reaches up to an altitude of 5300 m a.s.l.. For the 10 relevé-areas of nr. 3 different slates of micaschist, quartzites and clay-slates were found as soil forming rocks, and they are always present in a detrital form. At the time of the field investigations, the fine soil, which is poor in humus but rich in sand and silt, of these “ranker”-like mountain soils felt \pm moist. The carbonate reaction was positive at only one site with a pH of 7.4. At three other stands the pH-values were 5.8, 6.3 and 7.1.

With the four sampling areas of nr. 4 the community-group in the region of the Khardung La and the Chang La (12, 20) is represented. Basis for the soil development is detrital rock formed from granite. A debrisic fine soil from sand to silt forms the flat root horizon. The brown to dark-brown colour indicates a certain content of humus. In relation to acidity, pH-values of 5.3, 5.8 and 6.0 were recorded.

The high alpine grassland of the areas at Matho Phu, Stok Phu and Kanda La (13, 14) are shown by the nine relevés of nr. 5. Samples from seven different stands gave pH-values between 5.8 and 7.4.

In the high valley of Nimaling (14), the highest alpine turf of nr. 6 is documented with 10 relevés. Different exposition and inhomogeneous subsoil have an effect on the species composition. Nevertheless the pH in samples of eight stands varies only between 6.5 and 7.3!

6. The summarizing 6 main Tables in a general view

Altogether 343 relevés of the vegetation recorded in Ladakh are – predominantly summarized in communities and community-groups – compiled according to an approximate ecological relationship in the following six main Tables. In addition there are some single relevés which cannot yet be included in an already existing community. Ecologically and floristically set borderlines between the relevés of neighboring Tables are often not sharp. Altitude ranges of the different sites where the relevés were made (in m a.s.l.) are included in the Tables.

The figures **1 – 20** in bold indicate the areas of field work (phytosociological surveys), for details see chapter 2.

Table 1: Vegetation of the subalpine desert in the catchment area of the River Indus.

7 columns (3 of them with tables, 4 of them with one relevé each) with a total of **58** relevés.

- Communities of the lower subalpine belt: **9, 12**
- Communities of the higher subalpine belt: **10 – 13, 15**
- *Artemisia* steppe of a transitional zone to the alpine belt: **13**
- – Relevé within a transitional zone to the alpine belt in SE: **15**
- – Relevé within a transitional zone to the alpine belt N of Likir: **10**
- – Relevé in a depression: **12**
- – Relevé from a stand with additional water supply: **12**

Table 2: Subalpine steppe communities.

13 columns (7 of them with tables, 6 of them with 1 or 2 relevés each) with a total of **83** relevés.

- Community of *Koeleria cristata* / *Tanacetum artemisioides*: **2, 4b, 7**
- Community dominated by *Artemisia brevifolia*: **4, 6, 7, 8**
- Community of *Artemisia brevifolia* / *Tanacetum fruticosum*: **11, 12, 19**
- Community devoid of or with only sporadic *Artemisia brevifolia*: **4, 6**

- Community of *Artemisia wellbyi* / *Lindelofia anchusoides*: **4, 6**
- *Stachys tibetica* community on rock debris sites: **4, 9, 13**
- Relevés within a transitional zone to the alpine belt on Fotu La: **8**
- Relevés of a rock debris community devoid of or with only sporadic *Stachys tibetica*:
- Relevés in the low subalpine steppe-desert (W Ladakh): **3, 7**
- Relevés of the *Keoheria cristata* community: **4b**

Table 3: Subalpine turf and steppe-meadow communities (W Ladakh).

13 columns (bold-faced!) (8 of them with tables, 5 of them with 1 or 2 relevés each) with a total of **36** relevés.

- Community of *Koeleria cristata* and *Stipa pennata* ssp. *kirghisorum*: **2**
- *Bistorta affinis* community-group: **4b, c**
- Transitional zone between subalpine steppe and *Bistorta affinis* community: **2**
- *Artemisia brevifolia*-*Cicer microphyllum* community: **4d**
- Community-group of *Festuca kashmiriana* and *Poa suruana*: **4d**
- Grassland dominated by *Carex melanantha*: **4d**
- Relevé in grassland dominated by *Carex pseudofoetida*: **4c**
- Relevé in grassland dominated by *Kobresia schoenoides* and *Agrostis vinealis*: **4d**
- Relevés in grassland dominated by *Kobresia royleana* and *Leontopodium leontopodium*: **4a**

Table 4: Steppe and semidesert communities of the **alpine belt**.

12 columns (10 with tables, 2 with one relevé each) with a total of **88** relevés.

- *Aconogonon tortuosum*-*Nepeta glutinosa* community: **9**
- Community-group of *Elymus canaliculatus* and *Potentilla bifurca*: **13**
- Community-group of *Elymus canaliculatus* and *Thermopsis inflata* / *Biebersteinia odora*: **13**
- Community of *Stipa breviflora* / *Tanacetum fruticosum*: **14**
- Community-group of *Krascheninnikovia pungens* / *Ptilotrichum canescens*: **15, 16**
- Community-group of *Potentilla bifurca* / *Artemisia gmelinii*: **12, 19, 20**
- *Stipa glareosa*-*Krascheninnikovia pungens* community: **18, 20**
- *Stipa purpurea*-*Carex moorcroftii* community: **17, 18**
- Relevé in a succession stage of *Artemisia wellbyi*: **20**

Table 5: *Caragana versicolor* community and highalpine *Artemisia minor-Potentilla pamirica* steppe.
5 columns (3 with tables, 2 with one and two relevés each) with a total of 22 relevés.

- *Artemisia minor-Potentilla pamirica* community: **15**
- *Caragana* community of the region of Taglang La – Rupshu: **15, 16**
- *Caragana* community of the region of Kanda La and Matho Phu: **13**
- – Relevés in the *Caragana* community at the high valley of Nimaling: **14**
- – Relevé in the catchment area of Tso Moriri: **18**

Table 6: Grassland communities of the alpine and highalpine belt.
9 columns (6 with tables, 3 with one relevé each) with a total of 56 relevés.
 In addition 3 columns (10–12) with incomplete species-lists each.

- Community dominated by *Kobresia schoenoides*: **5**
- Community of *Nepeta discolor* / *Festuca kashmiriana*: **5**
- *Poa attenuata-Potentilla pamirica* community-group: **12, 13, 14, 16, 20**
- – Relevé in moist grassland at a plain: **15**
- – Relevé within higher *Kobresia* grassland: **15**
- – Relevé within *Carex* grassland (Rupshu): **16**
- – Incomplete species lists from Lachalung La and from the catchment area of Tso Moriri: **16, 18**

7. The vegetation summarized in the 6 main Tables

In the Table-“head” of the six main Tables, the first row contains the name of the community, community-group, etc. This is followed by serial numbers for the columns. The Table number given below refers to the number of the Table in the corresponding original paper, whose publication year is given in the last row of the Table-“head” (thus for example Table 3 in column nr.1 of the main Table 2 refers to the publication of 1983). The figures giving the cover are mean values in all columns based on more than 2 relevés. The listing of taxa within a main Table is sorted in order of decreasing presence degree (steadiness).

7.1 Vegetation of the subalpine desert in the catchment area of the River Indus (Table 1)

The subalpine desert between Upshi and Khalsi along the River Indus and along the “Old Route of Kashmir” from Ang to Likir is described with a total of 58 relevés. The geographical situation of the described localities is to see in Fig. 1 (1995).

Indications to the relevé-areas of Table 4 are included in HARTMANN (1983, Table 4, p. 159 and 172), and those of Table 1 in (1995, pp. 376). The four relevés in Table 2 (1995, p. 394) represent the transition of the *Artemisia*-steppe to the alpine belt, and the four single relevés from an altitude range of almost 1000 m are described in more detail on p. 389 – 393 (1995).

The most sparse desert vegetation turns out to be the community in the lowest part of the Indus ravine between Alchi and Khalsi. At the altitude between 3160 and 3310 m a.s.l., on a sample area of 150 m² four species hardly reach a coverage of 5 % (B). This coverage level is only achieved and slightly exceeded in 1 – 9 (A). The standard areas situated at clearly higher altitudes from the close and more remote surroundings of Leh (1983, Table 4 Nr. 3 – 9 and 1995, Table 1 Nr. 27, 28 and 32) at an altitude of 3600 – 3780 m a.s.l. contain an almost doubled number of species (7.9 per 150 m²).

A core group of five species characterizes the subalpine desert vegetation: *Nepeta floccosa*, *Echinops cornigerus*, *Haloxylon thomsonii*, *Corydalis flabellata* and *Bassia fedleri*. The former two have their main distribution in this community, the latter three have exclusively been found in the subalpine desert. *Ephedra regeliana* could also be added to these species. More rarely found, but distinct desert plants are also *Halogeton glomeratus*, *Bassia stellaris*, *Capparis spinosa*, *Nepeta annua*, *Lepidium latifolium*, *Peganum harmala* and *Perovskia abrotanoides*.

In the soils of the subalpine desert vegetation a carbonate content has been detected in all samples, independently of the nature of bedrock. Even on a pure granite subsoil, a pronounced to very pronounced carbonate reaction was recorded and accordingly the pH-values vary from 7.2 to 8.0. The cause of this phenomenon are processes which are summarized with the term “calcification“ (see HARTMANN 1995, p.374) and which are generally known to occur in dry regions.

With a coverage of less than 10% and a mean species number of less than 8 per 150 m² especially the lower subalpine desert vegetation up to an altitude of 3400 – 3500 m a.s.l. is of little attractiveness for herds of domestic animals. Sheep and goats, more rarely cows and dzos are the typical domestic animals in these regions. Their impact on the state of the plant cover in the higher subalpine belt (above 3500 m) is strongly dependent on the annual course of the weather and therefore changes from year to year (1995).

Table 1

Vegetation of the subalpine desert in the catchment area of the River Indus	Vegetation of the lower subalpine belt	Vegetation of the higher subalpine belt	Artemisia steppes of a transitional zone to the alpine belt	Transitional zone to the alpine belt in SE	Transitional zone to the alpine belt N of Likir	Relevé in a depression	Stand with additional water supply
Serial number (nr.)	1	2	3	4	5	6	7
Table-nr. / Relevé-nr.	Tab.4	Tab.1	Tab.2	269	273	219	215
Number of relevés	13	37	4	1	1	1	1
Altitude in m (a.s.l.) x 10	316-369	345-405	405-430	430	405	378	338
Cover (Ø) in %	5	11.2	46.3	15	25	15	10
pH of rhizosphere (Ø) / effective	7,7(10)	7,5(20)	7,4(2)	-	-	-	7,7
Number of taxa (Ø) / effective	5.3	10.1	10.8	9	15	22	17
Areas in Ladakh	9, 12	10-13, 15	13	15	10	12	12
Year of publication, 19..	83	95	95	95	95	95	95
<i>Stipa orientalis</i> Trin.	II ⁻²	IV ⁻²	III ⁺¹	1	2	+	(+)
<i>Euphorbia tibetica</i> Boiss.	II ⁺	II ⁻¹	III ⁻¹	+	+	1	.
<i>Tanacetum fruticosum</i> Ledeb.	II ⁻¹	IV ⁻²	V ⁺³	2	.	+	.
<i>Matthiola flavida</i> Boiss.	III ⁺²	III ⁻²	II ⁺	.	.	1	1
<i>Ephedra regeliana</i> Florin	II ⁻²	II ⁻²	.	.	+	2	2
<i>Crepis flexuosa</i> (DC.)Benth.et Hook.f.	+	III ⁺²	.	+	.	2	r
<i>Stachys tibetica</i> Vatke	.	III ⁺²	III ⁻¹	+	+	+	.
<i>Stipa himalaica</i> Roshev.	.	IV ⁻²	III ²	.	+	+	.
<i>Artemisia brevifolia</i> Wall.s.l.	.	II ⁻²	IV ³	.	3	+	.
<i>Piptatherum gracile</i> Mez	.	II ⁻¹	V ¹	.	1	+	.
<i>Oxytropis microphylla</i> (Pallas)DC.	.	r	.	2	+	+	.
<i>Carex stenophylla</i> Wahlenb.	.	r ²	II ¹	.	.	+	1
<i>Chesneya cuneata</i> (Benth.)Ali	II ⁻¹	II ⁺	.	.	.	+	.
<i>Erodium tibetanum</i> Edgew.	II ⁺	II ⁻¹	.	.	.	+	.
<i>Arnebia guttata</i> Bunge	+	II ⁻¹	.	.	.	.	r
<i>Nepeta leucolaena</i> Benth.ex Hook.f.	.	I ⁻²	III ¹⁻²	.	+	.	.
<i>Elymus canaliculatus</i> (Nevski)Tzvel.	.	+	IV ¹⁻²	.	1	.	.
<i>Astragalus oplites</i> Benth.	.	+	II ⁺	.	.	.	r
<i>Krascheninnikovia pungens</i> (L.)Guelden.	.	II ⁻²	.	.	.	+	2
* <i>Halogeton glomeratus</i> C.A.Mey.	.	II ⁻²	.	.	.	+	+
<i>Chenopodium botrys</i> L.	.	I ⁻¹	.	.	.	+	r
<i>Polygonum rotboelliioides</i> J.et Sp./ <i>polycnem.</i> J.et Sp.	.	+	.	.	.	1	2
<i>Chenopodium karo</i> (Murr)Aellen	.	+	.	.	.	+	(+)
<i>Nepeta floccosa</i> Benth.	IV ⁻²	IV ⁻²	.	.	.	.	.
* <i>Haloxylon thomsonii</i> Bunge	IV ⁻²	II ⁻²	.	.	.	.	.
<i>Echinops cornigerus</i> DC.	IV ⁻¹	II ⁻¹	.	.	.	.	.
* <i>Corydalis flabellata</i> Edgew.	+	I ⁻¹	.	.	.	.	.
* <i>Bassia fiedleri</i> Aellen	+	+	.	.	.	.	.
<i>Acantholimon lycopodioides</i> Boiss.	.	r	V ⁻¹	.	.	.	.
<i>Rosa webbiana</i> Wall.ex Royle	.	r ⁺	IV ^r	.	.	.	.
<i>Heracleum pinnatum</i> C.B.Clarke	.	r	II ^r	.	.	.	.
<i>Semenovia lasiocarpa</i> (Boiss.)Manden.	.	I ⁻²	.	.	+	.	.
<i>Cicer microphyllum</i> Benth.	.	+	.	.	+	.	.
<i>Minuartia kashmirica</i> (Edg.)Mattf.	.	r	.	.	+	.	.
<i>Silene moorcroftiana</i> Wall.	.	+	.	.	.	+	.
<i>Salsola tragus</i> L.	.	+	.	.	.	.	1
* <i>Bassia stellaris</i> (Moq.)Bornm.	.	+	.	.	.	.	1
<i>Potentilla bifurca</i> L.	.	.	II ⁺	1	.	.	.
<i>Gypsophila sedifolia</i> Kurz	.	.	.	.	+	+	.
* <i>Capparis spinosa</i> L.	I ⁺
<i>Christolea crassifolia</i> Camb.	.	I ⁻²	.	.	.	.	.
<i>Lactuca orientalis</i> Boiss.	.	I ⁻¹	.	.	.	.	.
<i>Polygonum paronychioides</i> C.A.Mey.	.	I ⁻¹	.	.	.	.	.
<i>Mattiastrium himalayense</i> Brand	.	+	.	.	.	.	.
<i>Physochlaina praealta</i> (D.Don)Hook.f.	.	+	.	.	.	.	.
* <i>Nepeta annua</i> Pallas	.	+	.	.	.	.	.
<i>Pennisetum flaccidum</i> Griseb.	.	+	.	.	.	.	.
<i>Cuscuta cf.capitata</i> Roxb.	.	+	.	.	.	.	.
<i>Rheum tibeticum</i> Maxim.	.	+	.	.	.	.	.
<i>Youngia tenuifolia</i> (Willd.)Bab.et Steb.	.	+	.	.	.	.	.
<i>Sisymbrium brassiciforme</i> C.A.Mey.	.	r	.	.	.	.	.
<i>Kochia prostrata</i> (L.)Schrab.	.	r	.	.	.	.	.
<i>Campanula pallida</i> Wall.var. <i>tibetica</i> (Hk.f.)Hara	.	r	.	.	.	.	.
<i>Perovskia abrotanoides</i> Karel.	.	r	.	.	.	.	.
* <i>Inula obtusifolia</i> Kerner	.	r	.	.	.	.	.
<i>Astragalus munroi</i> Benth.ex Bunge	.	r	.	.	.	.	.
* <i>Lepidium latifolium</i> L.	.	r	.	.	.	.	.
* <i>Peganum harmala</i> L.	.	r	.	.	.	.	.
<i>Artemisia gmelinii</i> Web.ex Steckm.	.	.	V ⁻²	.	.	.	.

Vegetation of the subalpine desert in the catchment area of the River Indus	Vegetation of the lower subalpine belt	Vegetation of the higher subalpine belt	Artemisia steppe of a transitional zone to the alpine belt	Transitional zone to the alpine belt in SE	Transitional zone to the alpine belt N of Likir	Relevé in a depression	Stand with additional water supply
Serial number (nr.)	1	2	3	4	5	6	7
Table-nr. / Relevé-nr.	Tab.4	Tab.1	Tab.2	269	273	219	215
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Cover (Ø) in %	5	11.2	46.3	15	25	15	10
pH of rhizosphere (Ø) / effective	7,7(10)	7,5(20)	7,4(2)	-	-	-	7,7
Number of taxa (Ø) / effective	5,3	10,1	10,8	9	15	22	17
Areas in Ladakh	<u>9, 12</u>	<u>10-13, 15</u>	<u>13</u>	<u>15</u>	<u>10</u>	<u>12</u>	<u>12</u>
Year of publication, 19..	83	95	95	95	95	95	95
<i>Nepeta glutinosa</i> Benth.	.	.	III ^{r-2}	.	.	.	1/7 IIIr-2
<i>Poa sterilis</i> M.Bieb.	.	.	II ^l	.	.	.	1/7 II ^l
<i>Stipa breviflora</i> Griseb.	.	.	.	2	.	.	1/7 2
<i>Ptilotrichum canescens</i> (DC.)C.A.Mey.	.	.	.	1	.	.	1/7 1
<i>Androsace robusta</i> Hd.-Mzt.ssp. <i>robusta</i> Y.Nasir	.	.	.	.	2	.	1/7 2
* <i>Senecio krascheninnikovii</i> Schischk.	.	.	.	.	.	+	1/7 +
* <i>Descurainia sophia</i> Webb.et Berth.	.	.	.	.	.	.	1/7 +
* <i>Medicago sativa</i> L.	.	.	.	.	.	.	1/7 r
* <i>Ephedra intermedia</i> Schrenk & Mey.	.	.	.	.	.	.	1/7 +

* species listed only in this table

7.2 Subalpine steppe communities (Table 2)

The steppe communities from the subalpine belt (2830 – 4320 m a.s.l.) are represented by 83 relevés. Most likely they cover the greatest part of the vegetation area of Ladakh. In the horizontal extension, the relevés originate from the western Dras Valley, the area of Kargil up to the southernmost part of the Suru Valley; from Zaskar and from the valley of Mulbekh up to Namika and Fotu La; from the left side of the Indus Valley close to Alchi Brok, from the region of Hemis to Matho and Stok and finally to Yurutse. Relevés of the right side of the valley are located between Ronga La and Leh, at the southern slope of the Khardung La as well as in the region between Leh, Tikse, Sakti up in the direction to the Chang La. Two stands were investigated at Khardung – at the northern slope of the similarly named pass.

First of all, the steppes in the true sense of the term can be distinguished from the desert communities on the one hand and from the turfs and steppe-turf communities of the subalpine belt on the other hand by the degree of vegetation cover. The mean cover of all the 83 relevés of the main Table 2 is around 45 % (20 – 65 %), whereas the cover of the 41 relevés from the desert between 3380 and 4300 m (Table 1, nr. 2 und 4 – 7) is only 11.7%. In the 13 relevés from 3160 to 3690 m a.s.l. (nr. 1 in Table 1) a cover of 5% is hardly surpassed. The 36 relevés of Table 3 on the other hand have a mean cover of 83.2 %. In the three main Tables, which present the vegetation of the subalpine belt, with the increasing vegetation cover the mean number of species per sample area is increasing too, although not evenly. All relevés from desert-like surroundings (Table 1) achieve a mean species number of 9.4. In the 83 stands of Table 2 with 17.0 an almost doubled species number is attained, and in the 36 relevés of Table 3 there are even 21.4 species per stand area.

A more pronounced floristic resemblance to the communities of the Tables 2 and 3 is reflected by the presence of some species in both communities. Besides the often dominating *Artemisia brevifolia* and *Koeleria cristata*, among the more frequent species, which are not or only rarely found in the other communities, are e.g. *Veronica biloba*, *Scorzonera virgata*, *Polygonum paronychioides*, *Dianthus anatolicus* and *Arenaria griffithii*.

For the community of *Koeleria cristata* / *Tanacetum artemisioides* from the Dras Valley and from the region of Mulbekh, *Chrysanthemum pyrethroides* var. *tomentosa*, *Pedicularis pycnantha*, *Psychrogeton andryaloides* var. *andryaloides*, *Koeleria cristata* and *Oxytropis mollis* are of significance in cover abundance. Limited to this community are among other species *Tanacetum artemisioides*, *Viola kunawarensis*, *Morina coulteriana*, *Artemisia persica* and *Bergenia stracheyi*. With an average of 21 species per sample area (12 relevés), the *Koeleria cristata*-community in W- Ladakh belongs to the most species-rich steppe vegetation, where also the mean cover is not far below 50%.

The *Artemisia*-steppe in the true sense from the Suru Valley, from Zaskar and from the region of Mulbekh up to the Indus Valley is summarized by column 3 and 4 (Table 2). Striking for this steppe community is the high predominance of *Artemisia brevifolia* with a high cover-abundance index ($V^{2/3-4}$). Important companions are *Scorzonera virgata*, *Polygonum paronychioides*, *Piptatherum laterale*, *Polygonum polycnemoides* / *rottboellioides*. In the W – SW variant (nr. 4) also *Nepeta discolor*, *Ephedra gerardiana*, *Dianthus anatolicus*, *Carex stenophylla* and *Draba cachemirica* are important. Representatives such as *Cynoglossum glochidiatum*, *Astragalus falconeri*, *Astragalus peduncularis*, *Orobanche cernua* and *Elymus x incertus* have not been found in relevés outside of the ones summarized in Table 2.

In the *Artemisia*-steppe from the valley of Mulbekh to the Indus Valley, *Acantholimon lycopodioides*, *Stipa orientalis* and *Oxytropis mollis* belong to the core group. Only in Table 2 registered are *Scrophularia nudata*, *Bupleurum gracillimum*, *Astragalus subuliformis*, *Astragalus nivalis*, *Koelpinia linearis* and *Astragalus macropterus*.

The *steppe with Artemisia brevifolia and / or Tanacetum fruticosum* (nr. 5, Table 2) is represented by relevés in the region of Umla, Phiyang, Gangles (N Leh), Sabu to Nang and Sakti. Two stands recorded to the west and southwest above Khardung give a view of the vegetation at the northern slopes of the Ladakh Range in the Shyok Valley. At the same time these are the localities situated at the lowest altitude. Not far below the desert follows. In five relevés of Table 1 (1999) from Gangles, Nang and Sakti *Artemisia brevifolia* is lacking. It has been emphasized (1999, p. 180), that this important *Artemisia* species is already in the region of Nang not present anymore and has presumably reached its easternmost border in this region of the Transhimalaya Range. The situation in the catchment of Leh is different. Here *Artemisia brevifolia* apparently is lacking only in the lowest parts of this community. The community which is also called *desert-steppe* presents the transition vegetation between desert and alpine steppe; accordingly it represents the higher tiers of the subalpine belt. Compared to the desert community, the mean species number is higher by around 5 – 6 per relevé, the cover value higher by at least a factor of three (mean cover 34.3 %).

Within the steppe communities of Table 2 this vegetation (nr. 5) is characterized by the lack of important companions, e.g. *Polygonum paronychioides*, *Piptatherum laterale*, *Polygonum polycnemoides* / *rottboellioides* and *Elymus cognatus*. But also characteristic species like *Stachys tibetica*, *Nepeta leucolaena*, *Tanacetum fruticulosum* and *Ephedra regeliana*, which within the steppe communities are otherwise present only in communities of coarse rock debris with *Stachys tibetica*, contribute to a distinction. Exclusively in this community are listed *Stipa caucasica* ssp. *caucasica*, *Stipa tianschanica*, *Astragalus hoffmeisteri* and *Berberis ulicina*.

The community nr. 6 (Table 2) without or only with scattered *Artemisia brevifolia* is in relation to the species composition close to the *Artemisia*-steppes. Among the most frequently recorded species are *Scorzonera virgata*, *Polygonum paronychioides*, *Astragalus oplites*, *Polygonum polycnemoides* / *rottboellioides*, *Elymus cognatus*, *Bromus oxyodon* (V⁺²) and *Carex stenophylla* (IV²). On the average 16 species per relevé and a mean cover of 58.3 % were registered for this community in the Suru Valley and in Zanskar (2 relevés).

Also in the Suru Valley and in Zanskar located are the 12 sampling plots, which include the three communities of coarse rock debris with *Artemisia wellbyi* and / or *Lindelofia anchusoides* (Table 2, nr. 7). Also here on the average 16 species attain a cover of 44.6 %. Besides the name-giving *Artemisia wellbyi* (IV^{r-3}) and *Lindelofia anchusoides* (IV⁺⁴), for this community-group *Nepeta discolor*, *Scorzonera virgata* and *Elymus cognatus* are more important. *Scrophularia koelzii*, *Chrysanthemum griffithii*, *Saussurea jacea* and *Rubia tibetica* have only been found in this community-group.

The community with generally dominating *Stachys tibetica* (nr. 8 and 9, Table 2) can be regarded as a specialist community, for the soil contains coarse rock debris up to the surface. As a consequence the plant cover as a rule does not reach 50 %. Sandstone, shales or a mixture thereof, but also gneisses form at the investigated sites the coarse rock debris. A mostly debrisic-sandy fine soil in the root-horizon is either rather loose or it is more or less compact. The eight relevés are geographically widely distributed: from the Suru Valley to Lardo or Alchi Brok up to the area of Matho, Stok and Yurutse.

The group of diagnostic species include, besides *Stachys tibetica* *Physochlaina praealta*, *Brachyactis roylei* and probably *Nepeta leucolaena*. Very constant companions are *Silene moorcroftiana* and *Heracleum pinnatum*. Only in this community listed are *Anaphalis virgata*, *Chenopodium foliosum* and *Valeriana clarkei*.

In Table 2 (1987) a distinction based on groups of differential species between an eastern (I) and a western (II) variant is made. The latter one contains with a number of 22 much more species per 100 m² than variant I with mere 15 taxa on the average.

Table 2

Subalpine steppe communities	Community of <i>Koeleria cristata</i> / <i>Tanacetum artemisioides</i>		Relevés in community of <i>Koeleria cristata</i>		Community dominated by <i>Artemisia brevifolia</i>		Community of <i>Artemisia brevifolia</i> / <i>Tanacetum fruticosum</i>		Community devoid of or with only sporadic <i>Artemisia brevifolia</i>		Community of <i>Artemisia wellbyi</i> / <i>Lindelia anchusoides</i>		Community of <i>Stachys tibetica</i> community on rock debris sites		Transitional zone to the alpine belt on Fotu La		Rock debris community devoid of or with only sporadic <i>Stachys tibetica</i>		Relevés of the low subalpine steppe-desert (W Ladakh)	
Serial number (nr.)	1	2	3	4	5	6	7	8	9	10	11	12	13							
Table-nr. / Relevé-nr.	Tab.3	65/71	Tab.3	Tab.1	Tab.1	Tab.1	Tab.3	Tab.2	31	23/24	181/182	147/148	13							
Number of relevés	12(I)	2	6(II)	15(I)	15	6(II)	12	7	1	2	2	2	1							
Altitude in m (a.s.l.) X 10	325-395	379/387	325-420	345-412	389-432	332-389	335-405	335-418	403	420/422	304/306	287/283	331							
Cover (Ø) in %	44	65/50	43	59	34.3	58.3	44.6	37.9	50	50/60	45/60	25/25	20							
pH of rhizosphere (Ø) / effective	7,1(10)	7.3	7,3(7)	5,6(9)	7,7(9)	5,8(5)	5,9(6)	7,2(2)	7.3	7,2(2)	-	6,65(2)	7.1							
Number of taxa (Ø) / effective	21	15/20	13	19.3	15.7	16	16	17.7	16	19/13	12/9	11/18	13							
Areas in Ladakh	<u>2, 7</u>	<u>4, b</u>	<u>7, 8</u>	<u>4, 6</u>	<u>11,12,19</u>	<u>4, 6</u>	<u>4, 6</u>	<u>4, 13</u>	<u>9</u>	<u>8</u>	<u>4</u>	<u>3</u>	<u>7</u>							
Year of publication, 19	83	87	83	87	99	87	87	87	83	83	87	83	83							
<i>Artemisia brevifolia</i> Wall.	IV ⁺²	/+	V ^{2,4}	V ^{3,4}	IV ⁺³	II ⁺	II ⁺	II ⁺	1	/+	.	/+	1	12/13	II-Vr-4,+1					
<i>Scorzonera virgata</i> DC.	IV ⁺¹	+1	IV ⁺¹	IV ⁺¹	III ⁺¹	V ⁺¹	IV ⁺¹	I ⁺	+	1/+	.	+1.	+	12/13	I-V+,-1,+1					
<i>Polygonum paronychioides</i> C.A.Mey.	IV ⁺²	1/1	V ⁺¹	III ⁻²	.	V ⁺¹	III ⁻¹	III ⁻¹	.	+1.	+1.	1/+	1	11/13	II-Vr-2,+1					
<i>Elymus canaliculatus</i> (Nevski)Tzvel.	III ⁺¹	/+	III ⁺	III ⁻¹	II ⁻²	III ⁺¹	III ⁻¹	III ⁺	+	1/1	.	.	.	10/13	II-III+,-2,+1					
<i>Piptatherum laterale</i> (Munr.ex Regel)Rosh.	III ⁻¹	.	V ⁺	IV ⁺²	.	III ⁺²	II ⁺²	IV ⁺²	+	1/.	2/2	/1	.	10/13	II-Vr-2,1-2					
<i>Astragalus opites</i> Benth.	+	2/.	III ⁺¹	II ⁻³	III ⁻²	V ⁺³	III ⁺²	.	.	1/.	.	1/.	+	10/13	+,-Vr-3,+2					
<i>Polygonum polycnemoides</i> J.et Sp./rottboell. J.et Sp.	II ⁺	2/2	V ⁺²	IV ⁺²	.	V ⁺²	IV ⁺¹	II ⁺	.	.	2/.	/+	.	9/11	II-V+,-2,+2					
<i>Silene moorcroftiana</i> Wall.	+	/+	I ⁺	+	II ⁻¹	.	III ⁺²	V ⁺²	.	1/1	.	/+	.	9/13	+V+,-2,+1					
<i>Psychrogeton andryaloides</i> Nov.var.andryal. Grs.	V ⁺²	/+	I ⁺	III ⁻¹	II ⁺	III ⁺	II ⁺	II ⁺	8/13	I-Vr-2,+					
<i>Nepeta discolor</i> Royle ex Benth.	II ⁻¹	.	.	V ⁺²	+	III ⁺³	V ⁻²	III ⁺²	r	1/.	.	.	.	8/13	+,-Vr-2,r-1					
<i>Semenovia lasiocarpa</i> (Boiss.)Manden.	III ⁺²	.	I ⁺	+	.	I ⁺	II ⁻¹	.	+	/r	.	r/.	.	8/13	+,-IIIr-2,r+1					
<i>Koeleria cristata</i> (L.)Pers.	IV ⁺³	3/2	I ⁺	III ⁻³	I ⁺	IV ⁺⁴	II ²	.	.	.	.	.	.	7/13	I-IVr-4,2-3					
<i>Eritrichium canum</i> Kitam.	IV ⁺²	.	III ⁺¹	I ⁻¹	II ⁺	.	.	IV ⁺¹	.	/1	.	.	+	7/13	I-IVr-2,+1					
<i>Ephedra gerardiana</i> Wall.	II ⁻¹	/+	I ⁺	IV ⁺²	.	I ⁺	I ⁺	6/13	I-IVr-2,+					
<i>Elymus cognatus</i> (Hack.)Cope	IV ⁺¹	.	III ⁻¹	III ⁻²	.	V ⁺²	IV ⁺²	II ⁻¹	.	.	.	.	.	6/13	II-V+,-2					
<i>Arabis tibetica</i> Hook.f.et Th.	II ⁺	.	II ⁺	.	+	.	I ⁺	.	+1.	.	.	.	.	6/13	I-II+,-1,+					
<i>Arnebia euchroma</i> (Royle)J.M.Johnst.var.	II ⁻¹	.	.	III ⁺	+	.	+	I ⁺	.	+1.	.	.	.	6/13	I-IIIr-1,+					
<i>Dianthus anatolicus</i> Boiss.	V ⁺²	.	.	V ⁻²	.	IV ⁺	II ⁺	.	.	.	+1.	1/.	.	6/13	II-V+,-2,+1					
<i>Carex pseudofloetida</i> Kük.	.	/1	I ⁺	I ⁺²	.	II ⁻²	II ⁻²	.	.	1/.	1/.	.	.	6/13	I-II+,-2,1					
<i>Androsace robusta</i> Hd.-Mzt.ssp.robusta Y.Nr.	III ⁻²	+1.	I ⁺	I ⁺	II ⁻¹	.	.	.	.	.	.	.	.	5/13	I-IIIr-2,+					
<i>Veronica biloba</i> L.	II ⁻²	1/2	.	III ⁺²	.	III ⁺²	I ⁺	5/13	I-III+,-2,1-2					
<i>Leontopodium leontopodium</i> (DC.)Hd.-Mzt.	III ⁺¹	/+	.	III ⁻³	+	I ⁺	5/13	+,-III+,-3,+					
<i>Carex stenophylla</i> Wahlenb.	I ⁺	.	.	III ⁺²	II ⁻²	IV ²	+	.	.	.	.	.	.	5/13	+,-IV+,-2					
<i>Thymus linearis</i> Benth.ssp.linearis Jalas	III ⁺²	.	.	II ⁻¹	.	IV ⁺¹	I ⁺	I ⁺	5/13	I-IVr-2					
<i>Cousinia thomsonii</i> Clarke	II ⁺	.	.	I ⁺	.	I ⁺	II ⁺	I ⁺	5/13	I-Ilr+,-					
<i>Acantholimon lycopodioides</i> (Gir.)Boiss.	III ⁻²	+2	V ⁺²	.	III ⁻¹	.	.	.	.	3/.	.	.	.	5/13	III-Vr-2,+3					
<i>Taraxacum</i> sp.	I ⁺	+1.	.	I ⁺	.	IV ⁺	.	.	.	+1/	.	.	.	5/13	I-IVr+,-+					
<i>Krascheninnikovia ceratoides</i> (L.)Gueld.	I ⁻¹	.	I ⁺	.	I ⁺	.	.	I ⁺	.	r/.	.	.	.	5/13	+,-1,r					
* <i>Scrophularia nudata</i> Pennell	I ⁺	.	II ⁻¹	.	.	.	+	II ⁺	.	.	.	+1/	.	5/13	+,-II+,-1,+					
<i>Euphorbia tibetica</i> Boiss.	I ⁺	.	.	.	IV ⁺¹	.	.	III ⁺	.	.	/1	1/.	.	5/13	I-IV+,-1,1					
* <i>Brachyactis roylei</i> (DC.)Wend.	.	+1.	.	.	.	I ⁺	II ⁺	III ⁺¹	+	.	.	.	.	5/13	I-III+,-1,+					
<i>Potentilla bifurca</i> L.fo.monstrosa Wolf*	.	+1.	.	.	III ⁻¹	I ²	.	II ⁺	.	+1.	.	.	.	5/13	I-IIIr-2,+					
<i>Artemisia wellbyi</i> Hemsl.et Pears.	.	.	.	+	I ⁺	.	IV ⁺³	II ⁺	.	.	3/.	.	.	5/13	+,-IVr-3,3					
<i>Stachys tibetica</i> Vathe	.	.	.	III ⁻¹	.	.	.	V ⁺³	3	.	.	/2	+	5/13	III-Vr-3,+2					
<i>Arenaria griffithii</i> Boiss.	III ⁺²	1/2	.	II ⁻¹	.	II ⁻¹	.	.	.	.	.	.	.	4/13	II-III+,-2,1-2					
<i>Poa sterilis</i> M.Bieb.	III ⁺²	.	.	II ⁺	+	I ⁺	4/13	+,-III+,-2					
<i>Crepis flexuosa</i> (DC.)Benth.ex Hook.f.	+	.	.	.	I ⁻¹	.	+	II ⁺	4/13	+,-II+,-1					
<i>Stipa orientalis</i> Trin.	III ⁺¹	.	V ⁺¹	.	IV ⁺²	.	.	.	.	.	.	2/+	.	4/13	III-V+,-2,+2					
* <i>Bromus tectorum</i> L.	+	.	.	.	.	.	.	II ⁺	.	.	1/+	/+	.	4/13	+,-II+,-+1					
<i>Oxytropis cachemiriana</i> Camb.	II ⁺	.	II ⁺	+1.	.	.	+	4/13	II+,-1,1					
<i>Chesneya cuneata</i> (Benth.)Ali	I ⁻¹	.	.	.	I ⁻¹	.	.	I ⁺	1	4/13	I+,-1					
<i>Aconogonon tortuosum</i> (D.Don)Hara	.	/+	.	.	.	.	III ⁻³	II ⁺	+	4/13	II-IIIr-3,+					
<i>Piptatherum gracile</i> Mez	.	.	.	I ²	V ⁺²	III ⁺³	III ⁺²	.	.	.	.	.	.	4/13	I-V+,-3					
<i>Bromus oxyodon</i> Schrenk	.	.	.	II ⁺¹	.	V ⁺²	III ⁻¹	I ⁺	4/13	I-V+,-2					
<i>Heracleum pinnatum</i> C.B. Clarke	.	.	.	+	II ⁺	.	III ⁺³	V ⁺¹	.	.	.	.	.	4/13	+,-Vr-3					
* <i>Cynoglossum glochidiatum</i> Wall.ex Benth.	.	.	.	+	.	.	II ⁺¹	II ⁺	.	.	/+	.	.	4/13	+,-II+,-1,+					
<i>Cicer microphyllum</i> Benth.	.	.	.	.	II ⁻¹	.	III ⁻³	I ⁺	+	4/13	I-IIIr-3,+					
<i>Artemisia gmelinii</i> Weber ex Steckm.	.	.	.	.	II ⁺	.	.	I ⁺	1	.	/4	.	.	4/13	I-Ilr+,-+1					
<i>Nepeta leucolaena</i> Benth.ex Hook.f.	.	.	.	.	IV ⁺²	.	.	III ⁺²	2	.	+1/	.	.	4/13	III-IVr-2,+2					
* <i>Melica persica</i> Kunth	.	.	.	.	+	.	I ⁺	III ⁺¹	.	.	.	/+	.	4/13	+,-III+,-1,+					
* <i>Filago arvensis</i> L.	.	.	.	.	.	III ⁺	.	I ⁺	.	.	+1.	/1	.	4/13	I-IIIr+,-+1					
<i>Gypsophila sedifolia</i> Kurz	I ⁺	.	I ⁺	.	II ⁺	3/13	I-Ilr+,-					
<i>Festuca alaica</i> Drob.	III ⁻¹	.	.	III ⁺²	.	I ⁺	3/13	+,-III+,-2					
<i>Bistorta affinis</i> (D.Don)Greene	+	.	.	II ⁻³	.	.	+	.	.	.	.	.	.	3/13	+,-II+,-3					
<i>Rosa webbiana</i> Wall.ex Royle	+	.	.	.	+	.	II ⁺	3/13	+,-IIr+,-					
<i>Matthiola flavida</i> Boiss.	II ⁻¹	.	.	.	III ⁺	.	.	I ⁺	3/13	I-IIIr-1					
<i>Nepeta floccosa</i> Benth.	+	.	I ⁺	II ⁻¹	.	.	.	.	.	3/13	+,-II+,-1					
<i>Leymus secalinus</i> (Georgi)Tzvel.	+	.	.	I ⁺	.	.	.	II ⁺	3/13	+,-II+,-					
<i>Oxytropis mollis</i> Royle	IV ⁺¹	.	IV ⁺¹	.	.	.	.	.	.	+1	.	.	.	3/13	IV+,-1,+1					
* <i>Bupleurum gracillimum</i> Klotzsch	II ⁻¹	.	II ⁻¹	.	.	.	.	.	.	1/2	.	.	.	3/13	IIr-1,1-2					
<i>Chrysanthemum pyrethroides</i> Ftsch.var.tomen.	III ⁺²	.	.	.	+	.	.	.	.	/+	.	.	.	3/13	+,-III+,-2					

Subalpine steppe communities	Community of <i>Koeleria cristata</i> / <i>Tanacetum artemisioides</i>	Relevés in community of <i>Koeleria cristata</i>	Community dominated by <i>Artemisia brevifolia</i>	Community of <i>Artemisia brevifolia</i> / <i>Tanacetum fruticosum</i>	Community devoid of or with only sporadic <i>Artemisia brevifolia</i>	Community of <i>Artemisia welbyi</i> / <i>Lindelofia anchusoides</i>	<i>Stachys tibetica</i> community on rock debris sites	Transitional zone to the alpine belt on Fotu La	Rock debris community devoid of or with only sporadic <i>Stachys tibetica</i>	Relevés of the low subalpine steppe-desert (W Ladakh)			
Serial number (nr.)	1	2	3	4	5	6	7	8	9	10	11	12	13
Table-nr. / Relevé-nr.	Tab.3	65/71	Tab.3	Tab.1	Tab.1	Tab.1	Tab.3	Tab.2	31	23/24	181/182	147/148	13
Number of relevés	12(I)	2	6(II)	15(I)	15	6(II)	12	7	1	2	2	2	1
Altitude in m (a.s.l.) X 10	325-395	379/387	325-420	345-412	389-432	332-389	335-405	335-418	403	420/422	304/306	287/283	331
Cover (Ø) in %	44	65/50	43	59	34.3	58.3	44.6	37.9	50	50/60	45/60	25/25	20
pH of rhizosphere (Ø) / effective	7,1(10)	7.3	7,3(7)	5,6(9)	7,7(9)	5,8(5)	5,9(6)	7,2(2)	7.3	7,2(2)	-	6,65(2)	7.1
Number of taxa (Ø) / effective	21	15/20	13	19.3	15.7	16	16	17.7	16	19/13	12/9	11/18	13
Areas in Ladakh	<u>2, 7</u>	<u>4, b</u>	<u>7, 8</u>	<u>4, 6</u>	<u>11,12,19</u>	<u>4, 6</u>	<u>4, 6</u>	<u>4, 13</u>	<u>9</u>	<u>8</u>	<u>4</u>	<u>3</u>	<u>7</u>
Year of publication, 19	83	87	83	87	99	87	87	87	83	83	87	83	83
* <i>Astragalus subuliformis</i> DC.	II*	.	I*	.	.	.	.	.	.	.	.	.	+
<i>Agrostis vinealis</i> Schreb.	.	2/.	.	.	.	II ¹⁻³	I ¹⁻³	.	.	.	.	.	.
<i>Tanacetum fruticosum</i> Ledeb.	.	/+	.	.	V ⁻³	.	.	III ¹⁻³	.	.	.	.	.
<i>Campanula pallida</i> Wall.var. <i>tibetica</i> Hara	.	/r	.	.	.	.	.	II ¹⁻¹	+	.	.	.	.
<i>Kochia prostrata</i> (L.)Schräd.	.	.	II ¹⁻¹	I ¹⁻¹	.	.	II ¹⁻¹	.	.	.	.	.	.
<i>Christolea crassifolia</i> Camb.	.	.	I*	.	+	.	.	I ¹	.	.	.	.	.
<i>Lonicera asperifolia</i> (Dcne.)Hook.f.et Th.	.	.	.	I*	.	.	+	I*	.	.	.	.	.
* <i>Astragalus falconeri</i> Bunge	.	.	.	+	.	.	II ¹⁻⁴	II*	.	.	.	.	.
<i>Nepeta glutinosa</i> Benth.	.	.	.	+	.	.	+	.	+	.	.	.	.
<i>Mattiasstrum himalayense</i> Brand	.	.	.	.	.	II*	II*	.	.	.	.	+	.
<i>Chenopodium botrys</i> L.	.	.	.	.	.	.	II ¹⁻⁴	I ¹	.	.	1/1	.	.
<i>Pedicularis pycnantha</i> Boiss.ssp. <i>typica</i> Penn.	V ¹⁻¹	.	II ¹⁻¹	.	.	.	.	.	.	.	.	.	.
<i>Thesium hookeri</i> Hedrych	+	.	I*	.	.	.	.	.	.	.	.	.	.
<i>Rosularia alpestris</i> (Kar.et Kir.)Boriss.	III ¹⁻¹	.	.	II*	.	.	.	.	.	.	.	.	.
<i>Tanacetum senecionis</i> (Jacq.ex Bess.)DC.	I ¹⁻⁴	.	.	I*	.	.	.	.	.	.	.	.	.
<i>Galium verum</i> L.	II ¹⁻³	.	.	.	.	I*	.	.	.	.	.	.	.
* <i>Cuscuta planiflora</i> Tenore	I*	.	.	.	.	.	+	.	.	.	.	.	.
<i>Senecio dubius</i> Ledeb.	+	.	.	.	.	.	.	I*	.	.	.	.	.
* <i>Chorispora sabulosa</i> Camb.	+	.	.	.	.	.	.	.	.	/+	.	.	.
* <i>Artemisia persica</i> Boiss.	+	.	.	.	.	.	.	.	.	.	.	/r	.
* <i>Tanacetum artemisioides</i> Schultz-Bip.	III ²	.	.	.	.	.	.	.	.	.	.	.	2
* <i>Viola kunawarensis</i> Royle	II*	.	.	.	.	.	.	.	.	.	.	.	+
<i>Draba cachemirica</i> Gandager	.	/r	.	III ¹⁻²	.	.	.	.	.	.	.	.	.
* <i>Astragalus nivalis</i> Kar.et Kir.	.	.	I*	.	.	.	.	.	.	/1	.	.	.
<i>Astragalus rhizanthus</i> Royle	.	.	.	II*	.	I*	.	.	.	.	.	.	.
<i>Lindelofia anchusoides</i> (Lindl.)Lehm.	.	.	.	II*	.	.	IV ¹⁻⁴	.	.	.	.	.	.
* <i>Astragalus peduncularis</i> Royle	.	.	.	I*	.	.	+	.	.	.	.	.	.
* <i>Orobancha cernua</i> Loeffl.	.	.	.	.	.	.	+	.	.	.	.	.	.
<i>Rheum webbianum</i> Royle	.	.	.	+	.	.	+	.	.	.	.	.	.
<i>Polygonum cognatum</i> Meissn.	.	.	.	+	.	.	+	.	.	.	.	.	.
<i>Thalictrum foetidum</i> L.	.	.	.	II*	.	.	.	I*	.	.	.	.	.
<i>Minuartia kashmirica</i> (Edgew.)Mattf.	.	.	.	+	.	.	.	.	.	+3	.	.	.
<i>Ephedra regeliana</i> Florin	.	.	.	.	III ¹⁻⁴	.	.	I*	.	.	.	.	.
<i>Stipa himalaica</i> Roshev.	.	.	.	.	II ¹⁻²	.	.	II ¹	.	.	.	.	.
<i>Cuscuta cf. capitata</i> Roxb.	.	.	.	.	.	I*	.	.	.	.	.	1	.
<i>Sisymbrium brassiciforme</i> C.A.Mey.	.	.	.	.	.	.	I ¹⁻³	III ¹⁻¹	.	.	.	.	.
<i>Physochlaina praealta</i> (Decne.)Miers	.	.	.	.	.	.	I*	IV*	.	.	.	.	.
<i>Verbascum thapsus</i> L.	.	.	.	.	.	.	II ¹⁻⁴	.	.	.	/+	.	.
* <i>Lactuca tatarica</i> C.A.M.var. <i>tibetica</i> Hook.f.	.	.	.	.	.	.	+	.	.	.	.	/+	.
* <i>Anaphalis virgata</i> Thoms.ex Clarke	.	.	.	.	.	.	.	I*	.	.	.	/+	.
<i>Echinops comigerus</i> DC.	.	.	.	.	.	.	.	.	r	.	.	+/+	.
<i>Stipa pennata</i> L.ssp. <i>kirghisorum</i> (Smr.)H.Fr.	II*	.	.	.	.	.	.	.	.	.	.	.	.
<i>Euphorbia thomsoniana</i> Boiss.	I ¹⁻⁴	.	.	.	.	.	.	.	.	.	.	.	.
* <i>Morina coulteriana</i> Royle	I ¹⁻⁴	.	.	.	.	.	.	.	.	.	.	.	.
* <i>Bergenia stracheyi</i> (Hook.f.et Th.)Engl.	+	.	.	.	.	.	.	.	.	.	.	.	.
<i>Jurinea ceratocarpa</i> Benth.var. <i>depressa</i> Clke.	.	1/+	.	.	.	.	.	.	.	.	.	.	.
<i>Poa cf. attenuata</i> Trin.	.	+2	.	.	.	.	.	.	.	.	.	.	.
* <i>Koelpinia linearis</i> Pallas	.	.	I*	.	.	.	.	.	.	.	.	.	.
* <i>Astragalus macropterus</i> DC.	.	.	I*	.	.	.	.	.	.	.	.	.	.
<i>Pedicularis pycnantha</i> Boiss.ssp. <i>semenovii</i> Pm.	.	.	.	II*	.	.	.	.	.	.	.	.	.
<i>Pulsatilla wallichiana</i> (Royle)Ulbr.	.	.	.	I ¹⁻²	.	.	.	.	.	.	.	.	.
<i>Festuca kashmiriana</i> Stapf	.	.	.	I ¹⁻²	.	.	.	.	.	.	.	.	.
<i>Tanacetum longifolium</i> Wall.ex DC.	.	.	.	I*	.	.	.	.	.	.	.	.	.
<i>Primula elliptica</i> Royle	.	.	.	I*	.	.	.	.	.	.	.	.	.
<i>Helictotrichon hookeri</i> (Scribn.)Henr.	.	.	.	I*	.	.	.	.	.	.	.	.	.
<i>Geranium cf. regelii</i> Nevski	.	.	.	I*	.	.	.	.	.	.	.	.	.
<i>Draba tibetica</i> Hk.f.et Th.var. <i>tibetica</i> Jafri	.	.	.	I*	.	.	.	.	.	.	.	.	.
<i>Rhodiola tibetica</i> (Hook.f.et Th.)Fu	.	.	.	I ¹⁻⁴	.	.	.	.	.	.	.	.	.
<i>Poa pratensis</i> L.ssp. <i>pruinosa</i> (Korot.)Dickoré	.	.	.	+	.	.	.	.	.	.	.	.	.
<i>Pseudomertensia echioides</i> (Benth.)Riedl	.	.	.	+	.	.	.	.	.	.	.	.	.
<i>Veronica lanosa</i> Royle ex Benth.	.	.	.	+	.	.	.	.	.	.	.	.	.
<i>Myosotis asiatica</i> Schischk.et Serg.	.	.	.	+	.	.	.	.	.	.	.	.	.
<i>Hieracium umbellatum</i> L.	.	.	.	r	.	.	.	.	.	.	.	.	.

Subalpine steppe communities	Community of <i>Koeleria cristata</i> / <i>Tanacetum artemisioides</i>		Relevés in community of <i>Koeleria cristata</i>		Community dominated by <i>Artemisia brevifolia</i>		Community of <i>Artemisia brevifolia</i> / <i>Tanacetum fruticosum</i>		Community devoid of or with only sporadic <i>Artemisia brevifolia</i>		Community of <i>Artemisia welbyi</i> / <i>Lindelia anchusoides</i>		Community of <i>Stachys tibetica</i> community on rock debris sites		Transitional zone to the alpine belt on Fotu La		Rock debris community devoid of or with only sporadic <i>Stachys tibetica</i>		Relevés of the low subalpine steppe-desert (W Ladakh)	
Serial number (nr.)	1	2	3	4	5	6	7	8	9	10	11	12	13							
Table-nr. / Relevé-nr.	Tab.3	65/71	Tab.3	Tab.1	Tab.1	Tab.1	Tab.3	Tab.2	31	23/24	181/182	147/148	13							
Number of relevés	12(I)	2	6(II)	15(I)	15	6(II)	12	7	1	2	2	2	1							
Altitude in m (a.s.l.) X 10	325-395	379/387	325-420	345-412	389-432	332-389	335-405	335-418	403	420/422	304/306	287/283	331							
Cover (Ø) in %	44	65/50	43	59	34.3	58.3	44.6	37.9	50	50/60	45/60	25/25	20							
pH of rhizosphere (Ø) / effective	7,1(10)	7.3	7,3(7)	5,6(9)	7,7(9)	5,8(5)	5,9(6)	7,2(2)	7.3	7,2(2)	-	6,65(2)	7.1							
Number of taxa (Ø) / effective	21	15/20	13	19.3	15.7	16	16	17.7	16	19/13	12/9	11/18	13							
Areas in Ladakh	2, 7	4,b	7, 8	4, 6	11,12,19	4, 6	4, 6	4, 13	9	8	4	3	7							
Year of publication, 19	83	87	83	87	99	87	87	87	83	83	87	83	83							
<i>Festuca rubra</i> L.ssp. <i>arctica</i> (Hack.)Govor.	-	-	-	+	-	-	-	-	-	-	-	-	-							1/13 +
* <i>Elymus x incertus</i> Hartm.	-	-	-	+	-	-	-	-	-	-	-	-	-							1/13 +
<i>Elymus schugnanicus</i> (Nevski)Tzvel.	-	-	-	-	II ¹⁻²	-	-	-	-	-	-	-	-							1/13 II+-2
<i>Oxytropis microphylla</i> DC.	-	-	-	-	II ¹⁻²	-	-	-	-	-	-	-	-							1/13 IIr-2
* <i>Stipa caucasica</i> Schmalh.ssp. <i>caucasica</i>	-	-	-	-	II ¹⁻⁴	-	-	-	-	-	-	-	-							1/13 II+-1
<i>Stipa caucasica</i> Schmalh.ssp. <i>glareosa</i> Tzvel.	-	-	-	-	I ¹	-	-	-	-	-	-	-	-							1/13 I1
* <i>Stipa tianschanica</i> Roshev.	-	-	-	-	I ¹	-	-	-	-	-	-	-	-							1/13 I+
* <i>Astragalus hoffmeisteri</i> (Klotzsch.)Ali	-	-	-	-	I ¹	-	-	-	-	-	-	-	-							1/13 I+
<i>Chamaerhodos sabulosa</i> Bunge	-	-	-	-	I ¹	-	-	-	-	-	-	-	-							1/13 I+
<i>Pennisetum flaccidum</i> Griseb.	-	-	-	-	I ¹	-	-	-	-	-	-	-	-							1/13 I+
<i>Lappula heterantha</i> (Led.)Gürke	-	-	-	-	I ¹⁺	-	-	-	-	-	-	-	-							1/13 Ir+
* <i>Berberis ulicina</i> Hook.f.et Th.	-	-	-	-	I ¹	-	-	-	-	-	-	-	-							1/13 Ir
<i>Artemisia stricta</i> Edgew.	-	-	-	-	+	-	-	-	-	-	-	-	-							1/13 +
<i>Allium przewalskianum</i> Regel	-	-	-	-	+	-	-	-	-	-	-	-	-							1/13 +
<i>Astragalus munroi</i> Benth.ex Bunge	-	-	-	-	+	-	-	-	-	-	-	-	-							1/13 +
<i>Arnebia guttata</i> Bunge	-	-	-	-	+	-	-	-	-	-	-	-	-							1/13 +
<i>Potentilla argyrophylla</i> Wall.var. <i>leucochroa</i> Hk.f.	-	-	-	-	-	I ¹	-	-	-	-	-	-	-							1/13 I+
* <i>Scrophularia koelzii</i> Penn.	-	-	-	-	-	-	II ¹⁻¹	-	-	-	-	-	-							1/13 II+-1
* <i>Chrysanthemum griffithii</i> Clarke	-	-	-	-	-	-	+	-	-	-	-	-	-							1/13 +
* <i>Saussurea jacea</i> (Klotzsch)Clarke	-	-	-	-	-	-	+	-	-	-	-	-	-							1/13 +
* <i>Rubia tibetica</i> Hook.f.	-	-	-	-	-	-	+	-	-	-	-	-	-							1/13 +
<i>Lepidium apetalum</i> Willd.	-	-	-	-	-	-	-	II ¹	-	-	-	-	-							1/13 II+
<i>Chenopodium</i> cf. <i>karo</i> (Murr)Aellen	-	-	-	-	-	-	-	I ¹	-	-	-	-	-							1/13 I+
* <i>Chenopodium foliosum</i> (Moench)Asch.	-	-	-	-	-	-	-	I ¹	-	-	-	-	-							1/13 I+
<i>Axyris hybrida</i> L.	-	-	-	-	-	-	-	I ¹	-	-	-	-	-							1/13 I+
<i>Lonicera spinosa</i> (Decne.)Walp.	-	-	-	-	-	-	-	I ¹	-	-	-	-	-							1/13 Ir
* <i>Valeriana clarkae</i> Briq.	-	-	-	-	-	-	-	I ¹	-	-	-	-	-							1/13 Ir
* <i>Potentilla salesoviana</i> Steph.	-	-	-	-	-	-	-	-	+	-	-	-	-							1/13 +
<i>Bupleurum thomsonii</i> C.B.Clarke	-	-	-	-	-	-	-	-	-	2/.	-	-	-							1/13 2
* <i>Convolvulus arvensis</i> L.	-	-	-	-	-	-	-	-	-	-	+/+	-	-							1/13 +
* <i>Artemisia scoparia</i> Waldst.& Kit.	-	-	-	-	-	-	-	-	-	-	1/.	-	-							1/13 1
<i>Lactuca orientalis</i> Boiss.	-	-	-	-	-	-	-	-	-	-	-	1/+	-							1/13 +-1
* <i>Trigonella</i> sp.	-	-	-	-	-	-	-	-	-	-	-	+/.	-							1/13 +
<i>Perovskia abrotanoides</i> Karel.	-	-	-	-	-	-	-	-	-	-	-	./+	-							1/13 +
* <i>Medicago falcata</i> L.	-	-	-	-	-	-	-	-	-	-	-	./r	-							1/13 r

* species listed only in this table

7.3 Subalpine turf and steppe-meadow communities of W Ladakh (Table 3)

A turf or steppe-turf is found if the cover of the stands reaches a higher level (average of the 36 relevés is 83.2%) which is – as already mentioned – almost double the values of the steppe communities. The number of the species is generally also – as previously indicated – clearly higher (21.4 on the average per relevé). The highest species number were recorded in W Ladakh in the Dras- and Suru Valley. Above Matayan at 3550 m a.s.l. there are 37 species per 100 m² in a dry meadow with *Koeleria cristata* and *Stipa pennata* ssp. *kirghisorum*. In a relevé of the community with *Gentiana moorcroftiana* and *Cerastium cerastioides* at 4160

m a.s.l., which belongs to the community-group with *Bistorta affinis*, to the east of Kartse in the Suru Valley, 36 species were found.

The generally rather dense meadows of the subalpine and lower alpine belt were not found anymore further to the east, in the central and E Ladakh. Most likely they are limited to the region at the southwestern edge close to the climatic border. This equally holds true for the name-giving species of the corresponding community-groups: *Stipa pennata* ssp. *kirghisorum*, *Bistorta affinis*, *Festuca kashmiriana*, *Poa suruana* and *Carex melanantha*.

In the dry meadow with *Koeleria cristata* and *Stipa pennata* ssp. *kirghisorum* (nr.1 and 2 in Table 3) the name-giving taxa are conspicuous by their high cover-abundance. Further representative species are also *Oxytropis mollis*, *Helictotrichon hookeri* and *Bromus confinis*. A significant number of species has only been found in this community. These include *Galium boreale*, *Pedicularis kashmiriana*, *Hieracium prenanthoides*, *Geranium pratense* ssp. *stewartianum*, *Tragopogon dubius*, *Iris hookeriana*, but also *Androsace aizoon* var. *himalaica*, *Artemisia parviflora* and *Erysimum mellicentae*. Only in the transition zone to the *Bistorta affinis*-community *Viola rupestris* and *Gentiana borealis* were found.

The dense vegetation cover and the striking species richness are without doubt signs of increased precipitation during the vegetation season. Linked to this is an improved soil development with a fine soil and with a slightly enhanced humus-content.

The 8 and 10 relevés of a community-group with *Bistorta affinis* (nr. 4, 5 and 3, Table 3) are distributed accross the Dras- and Suru Valleys. Situated in the latter are the three relevés in a side valley of the Chellong River, which empties into the Suru Valley near Panikhar, and five are located in a side valley to the east of Kartse. Two stands of nr. 3 are situated above Yasghun in the Dras Valley. The slopes are exposed to the NW, NE and to the N. In the vertical direction, the colourful low creeping *Bistorta-turf* can be found from around 3500 m up to 4300 m a.s.l. Since *Bistorta affinis* forms at an optimal position extensive carpet-like mats, which turn red at the time when the fruits are ripe. These stands can be discerned in late summer from a large distance.

Optimal conditions for these espalier-turfs are met in the most precipitation-rich areas, which means at the slopes of the Himalaya main Range exposed more or less to the N, thus to the NW of the Zoji La in south-eastern direction to the region of Zaskar. This community was still investigated in the Dras Valley above Yasghun and in the Suru Valley as well as in the side valley to the east of Sanku. Much further to the north and east of Ladakh this vegetation is most likely lacking. The transition into alpine turf-communities, which turning to screes with increasing altitude is gradual.

In addition it needs to be added that in the turfs of *Bistorta affinis* also *Salix karelinii* can be present, wherever it has not been reduced or eliminated by human intervention (s. Tab. 1 p. 550, 1990). The complete species list of the corresponding relevé Nr. 8 shows, that it is a *Bistorta affinis*-stand which is overgrown by *Salix karelinii*

in a way that further species are lacking which could set up an autonomous shrub community. For further questions relating to the *Salix karelinii*-shrubs and the comparison with the corresponding vegetation in the neighbouring Karakorum reference is made to p. 528 / 529 (1990).

The characteristic species of the community-group include *Festuca alaica*, *Primula elliptica*, *Gentiana tianshanica*, *Arenaria griffithii*, *Thalictrum foetidum* and most likely also *Draba cachemirica*, *Androsace robusta* and *Pulsatilla wallichiana*. The most frequent representatives include *Leontopodium leontopodium*, *Dianthus anatolicus* and *Rosularia alpestris*. Almost exclusively in this community found were *Gentiana moorcroftiana* and *Oxytropis lapponica*.

Within the community-group of *Bistorta affinis* two communities were distinguished: on the one hand a species combination I, which is present rather in the subalpine belt with *Polygonum polycnemoides* and *Veronica biloba* and on the other hand the community II with *Gentiana moorcroftiana* and *Cerastium cerastioides*, which is rather present at slightly higher altitudes. The latter can be distinguished from the former by a significant number of differential species (s.p. 550, 1990), for example *Pulsatilla wallichiana*, *Festuca olgae*, *Pedicularis pectinata*, *Tanacetum senecionis*, *Delphinium cashmerianum*, *Kobresia capillifolia* and *Lomatogonium coeruleum*.

The community with *Artemisia brevifolia* and *Cicer microphyllum* (nr. 6, Table 3) also gains by the higher precipitation rates directly behind the Himalaya main Range in the southernmost Suru Valley between Rangdum and Parkutse. This community colonizes slopes on coarse rock debris from 3900 m to about 4300 m a.s.l., sites which in more dry areas are colonized by *Stachys tibetica* or other steppe-like communities on coarse rock debris. With the mean cover of 80% and around 20 different taxa per 100 m² these stands give at the most a weak steppe-like impression. Although a significant part of the species is already known, such a vegetation on coarse rock debris gives a more luxuriant and without doubt also a more colourful impression. Besides the dominating *Artemisia brevifolia* and *Cicer microphyllum* also *Piptatherum laterale*, *Lindelofia anchusoides*, *Aconogonon tortuosum*, *Poa suruana* as well as *Pedicularis pycnantha* ssp. *semenovii* and *Calamagrostis epigejos* belong to the characteristic species combination.

Also limited to the most precipitation rich parts of the country in the S and SW is presumably the community-group with *Festuca kashmiriana* and *Poa suruana* (nr. 7, 8, 9 in Table 3). The two name-giving grass species have been found exclusively in the regions of Ladakh close to the Himalaya. The share of mesophytic species is, in comparison with the *Artemisia brevifolia* – *Cicer microphyllum*-community, further enhanced and the mean cover varies between 72.5% and 86.4%. As diagnostic and differential species for the floristic delimitation from the *Artemisia brevifolia* – *Cicer microphyllum*-community besides *Festuca kashmiriana* the following species should be mentioned: *Astragalus rhizanthus*, *Geranium himalayense*, *Carex moorcroftii*, *Veronica biloba* and presumably *Arabis tibetica*. The characteristic species combination includes *Poa suruana*, *Polygonum polycnemoides* and *Carex moorcroftii*. Exclusively or almost exclusively in this community were found: *Pedicularis pyramidata*, *Calamagrostis epigejos* and *Brachyactis pubescens*. From a physiognomical point of view, such stands present themselves predominantly as meadows in which often tufts of *Festuca kashmiriana* or *Carex moorcroftii* and more rarely *Poa suruana* dominate (Photo 10 and 11, 1987).

Everywhere, but only for certain limited time periods, this vegetation is exposed to rather strong grazing by herds of sheep and goats. The plant cover is subject to the strongest grazing pressure at the bottom of the valleys next to the roads, and here especially by horses. Since these turf-areas are ideal camp sites for placing tents, they are repeatedly used by caravans. Since *Carex moorcroftii* is spared by domestic animals, this sedge has presumably spread selectively at sites with high pasture usage (Photo 12, 1987).

A relevé was made (nr. 10) of relatively high growing meadows of the lower alpine belt with always dominating *Carex melanantha* in a small northern side valley of the Suru River to the west of Sanmodangsa (Gulmatungo). At least $\frac{3}{4}$ of the stand surface are covered by the sedge (V⁵) whose fresh, bright-green colour allows to distinguish the community from a large distance from the neighbouring turfs and screes. The meadow-like impression of these species-poor stands is mainly due to the dense and relatively high growth of *Carex melanantha*. Without a closer inspection, only few companion-species stand out besides the all-dominating sedge, be it for their higher growth as for example *Alopecurus arundinaceus* and *Rheum webbianum* or by remarkable colour of the flowers, as is the case for *Aconitum violaceum* and *Geranium himalayense* (Photo 3, 1990). Among the 12 to 16 species per 100 m² especially the following representatives form a characteristic species group: besides the always dominating *Carex melanantha* *Geranium himalayense*, *Astragalus tecti-mundi*, *Bupleurum longicaule* var. *himalayense*, *Rheum webbianum* as well as *Alopecurus arundinaceus* and *Selinum papyraceum*. An occasional weak influence by grazing animals appears to have overall a weak effect since the hard sprouts of the dominating sedge are hardly desired as feed.

Table 3

Subalpine turf and steppe-meadow communities (W Ladakh)	Community of <i>Koeleria cristata</i> and <i>Stipa pennata</i> ssp. <i>kirghisorum</i>		Transitional zone betw subalp steppe and <i>Bistorta affinis</i> community	<i>Bistorta affinis</i> community-group		<i>Artemisia brevifolia</i> - <i>Cicer microphyllum</i> community		Community-group of <i>Festuca kashmiriana</i> and <i>Poa suruana</i>			Grassland dominated by <i>Carex melanantha</i>	Grassland dominated by <i>Carex pseudofloetida</i>	Grassland dominated by <i>Kobresia schoenoides</i> and <i>Agrostis vinealis</i>	Grassland dominated by <i>Kobresia royleana</i> and <i>Leontopodium leontopodium</i>
Serial number (nr.)	1	2	3	4	5	6	7	8	9	10	11	12	13	
Table-nr. / Relevé-nr.	Tab.1	6	Tab.2	Tab.1	Tab.1	Tab.4	Tab.5	Tab.5	87	Tab.2	102	93	61/63	
Number of relevés	2	1	2	5	3	6	7	2	1	3	1	1	2	
Altitude in m (a.s.l.) x 10	355/345	337	354	358-387	406-416	391-419	388-417	434/438	419	419-430	364	405	388/403	
Cover (Ø) in %	80/95	50-60	65/80	81	80	80	86.4	72.5	85	98.3	90	100	90/85	
pH of rhizosphere (Ø) / effective	5,4(3)	6	5,3(2)	5,6(2)	6,1(2)	5,7(3)	5,1(3)	-	5.0	4,3(2)	5.3	4.5	5.6	
Number of taxa (Ø) / effective	37/30	23	21/30	23	32.7	19.7	17.9	19	26	13.7	12	24	16/17	
Areas in Ladakh	2	2	2	4 b,c	4 b	4 d	4 d	4 d	4 d	4 d	4 c	4 d	4 a	
Year of publication, 19..	83	83	83	90	90	87	87	87	87	90	87	90	90	
<i>Nepeta discolor</i> Royle ex Benth.	1/2	1	+/+	II*	V ¹	V ⁻³	IV ⁻³	2/2	2	II*	.	.	.	10/13 II-V+-3,+2
<i>Koeleria cristata</i> (L.)Pers.	3/1	3	3/+	V ¹⁻²	IV ²⁻¹	III ⁻²	V ⁻³	+/.	2	.	+	.	.	10/13 III-V+-3,+3
<i>Leontopodium leontopodium</i> (DC.)Hd.-Mzt.	2/1	+	1/+	V ⁻²	V ²⁻³	.	I ¹	+/.	+	.	2	.	2/2	10/13 I-V+-3,+2
<i>Poa sterilis</i> M.Bieb.	+/+	2	+/.	II ⁻¹	V ²	III ⁻²	III ⁻¹	.	1	II ²	.	.	.	9/13 II-V+-2,+2
<i>Rheum webbianum</i> Royle	+/.	+	.	.	.	III*	II*	+/.	+	V*	.	r	.	8/13 II-V+-1,r+
<i>Dianthus anatolicus</i> Boiss.	.	1	+/+	V ⁻¹	V ⁻¹	I*	III*	2/+	.	.	r	.	.	8/13 I-V+-1,r-2
<i>Scorzonera virgata</i> DC.	+/+	1	+/+	III*	.	V ⁻¹	III ⁻¹	1/.	.	.	.	.	.	7/13 III-V+-1,+1
<i>Veronica biloba</i> L.	/2	1	1/.	III ¹⁻²	.	.	IV ²⁻²	.	.	.	2	+	.	7/13 III-IV1-2,+2
<i>Artemisia brevifolia</i> Wall.s.l.	.	.	2/1	III ⁻³	.	V ⁻⁴	III*	1/2	+	.	r	.	.	7/13 III-V+-4,r-2
* <i>Poa suruana</i> Hartmann	.	.	.	I*	.	IV ⁻²	V ⁻³	1/2	1	IV*	.	1	.	7/13 I-V+-3,1-2
<i>Rosularia alpestris</i> (Kar.et Kir.)Boriss.	1/+	.	1/+	IV*	V*	I*	.	.	1	.	.	.	.	6/13 I-V+-1
<i>Polygonum polycnemoides</i> Jb.et Sp.	/1	2	.	V ⁻²	.	III ⁻²	V ⁻²	.	.	.	2	.	.	6/13 III-V+-2,1-2
<i>Astragalus rhizanthus</i> Royle	+2	.	.	II*	.	I*	V ⁻²	1/1	.	.	.	+	.	6/13 I-V+-2,+2
<i>Polygonum paronychioides</i> C.A.Mey.	.	1	.	I*	.	V ⁻¹	II*	+1	+	.	.	.	.	6/13 I-V+-1,+1

Subalpine turf and steppe-meadow communities (W Ladakh)	Community of <i>Koeleria cristata</i> and <i>Stipa pennata</i> ssp. <i>kirghisorum</i>		Transitional zone betw. subalp. steppe and <i>Bistorta affinis</i> community	<i>Bistorta affinis</i> community-group		<i>Artemisia brevifolia</i> - <i>Cicer microphyllum</i> community	Community-group of <i>Festuca kashmiriana</i> and <i>Poa suruana</i>			Grassland dominated by <i>Carex melanantha</i>	Grassland dominated by <i>Carex pseudofoetida</i>	Grassland dominated by <i>Kobresia schoenoides</i> and <i>Agrostis vinealis</i>	Grassland dominated by <i>Kobresia royleana</i> and <i>Leontopodium leontopodium</i>
Serial number (nr.)	1	2	3	4	5	6	7	8	9	10	11	12	13
Table-nr. / Relevé-nr.	Tab.1	6	Tab.2	Tab.1	Tab.1	Tab.4	Tab.5	Tab.5	87	Tab.2	102	93	61/63
Number of relevés	2	1	2	5	3	6	7	2	1	3	1	1	2
Altitude in m (a.s.l.) x 10	355/345	337	354	358-387	406-416	391-419	388-417	434/438	419	419-430	364	405	388/403
Cover (Ø) in %	80/95	50-60	65/80	81	80	80	86.4	72.5	85	98.3	90	100	90/85
pH of rhizosphere (Ø) / effective	5,4(3)	6	5,3(2)	5,6(2)	6,1(2)	5,7(3)	5,1(3)	-	5.0	4,3(2)	5.3	4.5	5.6
Number of taxa (Ø) / effective	37/30	23	21/30	23	32.7	19.7	17.9	19	26	13.7	12	24	16/17
Areas in Ladakh	<u>2</u>	<u>2</u>	<u>2</u>	<u>4.b.c</u>	<u>4.b</u>	<u>4.d</u>	<u>4.d</u>	<u>4.d</u>	<u>4.d</u>	<u>4.d</u>	<u>4.c</u>	<u>4.d</u>	<u>4.a</u>
Year of publication, 19..	83	83	83	90	90	87	87	87	87	90	87	90	90
<i>Draba cachemirica</i> Gandager	.	.	+/+	V ¹⁻³	V ⁺²	I ⁺	I ⁺	2/1	.	.	.	.	6/13 I-V+3,1-2
<i>Oxytropis mollis</i> Royle	J/+	1	1/+	I ⁺	II ⁺	5/13 I-II1,+1
<i>Ephedra gerardiana</i> Wall.	2/r	.	.	II ⁺	II ⁺	II ^{r+}	I ⁺	5/13 I-IIr-1,r-2
<i>Piptatherum laterale</i> (Regel)Rosh.	+/+	1	.	III ^{r+}	.	V ⁺²	III ^{r+}	.	.	.	.	.	5/13 III-V+2,+1
<i>Lindelofia anchusoides</i> (Lindl.)Lehm.	+/+	+	.	I ⁺	.	V ⁺²	III ⁺	5/13 I-Vr-2,+
<i>Thymus linearis</i> Benth.ssp. <i>linearis</i> Jalas	.	.	3/3	III ^{r+}	II ²	I ⁺	.	1/.	.	.	.	.	5/13 I-III+2,1-3
<i>Bistorta affinis</i> (D.Don)Greene	.	.	+4	V ³⁻⁵	V ²	I ⁺	.	+3	.	.	.	.	5/13 I-V+5,+4
<i>Taraxacum</i> sp.	.	.	.	III ^{r+}	II ⁺	.	I ⁺	.	.	.	+	.	5/13 I-IIIr-1,+
<i>Cicer microphyllum</i> Benth.	.	.	.	.	.	V ⁺²	III ¹⁻²	1/1	2	II ⁺	.	.	5/13 II-V+2,1-2
<i>Epilobium angustifolium</i> L.	.	.	.	.	.	IV ⁺	V ^{r+}	J/+	+	V ^{r+}	.	.	5/13 IV-V+1,+
<i>Geranium himalayense</i> Klotzsch	.	.	.	.	.	.	III ^{r+}	+1	1	V ¹⁻²	.	+	5/13 III-Vr-2,+1
<i>Helictotrichon hookeri</i> (Scribn.)Henr.	1/1	.	+/+	I ⁺	II ⁺	4/13 I-II+1,+1
<i>Stipa pennata</i> L.ssp. <i>kirghisorum</i> (Smirn.)H.f.	1/3	1	.	.	.	I ⁺	III ^{r+}	.	.	.	.	.	4/13 I-III+1,1-2
<i>Polygonum cognatum</i> Meissn.	1/+	+	.	.	.	.	I ⁺	J/+	.	.	.	.	4/13 I+1,+1
<i>Tanacetum senecionis</i> DC.	1/.	.	.	.	V ^{r+}	.	.	2/.	+	.	.	.	4/13 V+1,+2
<i>Myosotis asiatica</i> Schischk.et Serg.	1/2	.	.	III ⁺	II ⁺	IV ⁺	.	.	4/13 II-IV+1,1-2
* <i>Poa pratensis</i> L.ssp. <i>pratensis</i> Dickoré	1/1	.	.1	.	.	.	I ⁺	4/13 I+1,+1
<i>Elymus canaliculatus</i> (Nevski)Tzvel.	.	.	.	II ^{r+}	II ⁺	IV ^{r+}	III ¹⁻²	.	.	.	.	.	4/13 II-IV+2
<i>Pseudomertensia echioides</i> (Benth.)Rdl.	.	.	.	II ^{r+}	IV ⁺	II ⁺	.	.	+	.	.	.	4/13 II-IV+1,+
<i>Agrostis vinealis</i> Schreb.	.	.	.	II ^{r+}	.	.	.	.	.	.	2	3	2/1
* <i>Bupleurum longicaule</i> Wall.var. <i>himalayense</i> Cl.	.	.	.	.	IV ^{r+}	.	.	.	+	V ^{r+}	.	1	4/13 IV-V+1,+1
<i>Carex pseudofoetida</i> Kük.	.	.	.	.	II ⁺	.	I ⁺	.	.	.	4	.	1/.
<i>Aconogonon tortuosum</i> (D.Don)Hara	.	.	.	.	.	IV ²⁻⁴	.	+1	+	IV ⁺	.	.	4/13 IV+4,+1
<i>Festuca kashmiriana</i> Stapf	.	.	.	.	.	.	V ^{r+}	4/2	3	V ^{r+}	.	.	4/13 V+4,2-4
* <i>Alopecurus arundinaceus</i> Poir.	.	.	.	.	.	.	III ^{r+}	.	+	V ^{r+}	.	1	4/13 III-V+1,+1
<i>Bromus confinis</i> Nees ex Steud.	1/+	+	J/+	.	.	.	.	.	.	.	.	.	3/13 +1
<i>Thesium hookeri</i> Hedrych	+/+	.	.	I ⁺	.	I ⁺	3/13 Ir+1
<i>Aster flaccidus</i> Bge.ssp. <i>flaccidus</i> Griens.	+/.	.	.	.	IV ^{r+}	.	.	.	+	.	.	.	3/13 IV+1,1
<i>Festuca alaica</i> Drob.	.	.	2/1	V ^{r+}	V ¹⁻²	.	.	.	.	.	.	.	3/13 V+2,1-2
<i>Primula elliptica</i> Royle	.	.	+/+	II ⁺	V ^{r+}	.	.	.	.	.	.	.	3/13 II-V+1,+
<i>Arenaria griffithii</i> Boiss.	.	.	2/.	III ⁺	II ⁺	3/13 II-III+2
<i>Thalictrum foetidum</i> L.	.	.	J/+	II ⁺	II ⁺	3/13 II+1
<i>Gentiana tianshanica</i> Rupr.	.	.	J/+	II ⁺	V ⁺²	.	.	.	.	.	.	.	3/13 II-V+2,+
<i>Pedicularis pycnantha</i> Boiss.ssp. <i>semenovii</i> Pr.	.	.	.	I ⁺	.	IV ⁺	.	+/+	3/13 I-IV+1
* <i>Oxytropis lapponica</i> (Wahl.)Gay	.	.	.	I ⁺	IV ⁺	1/1	3/13 I-IV+1,1
<i>Saussurea falconeri</i> Hook.f.	.	.	.	.	IV ^{r+}	.	.	.	+	II ⁺	.	.	3/13 II-IV+1,+
* <i>Pedicularis bicornuta</i> Klotzsch	.	.	.	.	II ⁺	.	.	.	+	.	+	.	3/13 II+1
<i>Psychogeton andryaloides</i> (DC.)Nov.var. <i>andr.</i>	.	.	.	.	.	I ⁺	I ⁺	+/.	3/13 Ir+1
<i>Arabis tibetica</i> Hook.f.et Th.	.	.	.	.	.	I ⁺	IV ^{r+}	.	+	.	.	.	3/13 I-IV+1,+
* <i>Astragalus tecti-mundi</i> Freyn.	.	.	.	.	.	I ⁺	.	.	+	V ^{r+}	.	.	3/13 I-V+1,+
* <i>Pedicularis pyramidata</i> Royle	.	.	.	.	.	.	I ⁺	1/1	+	.	.	.	3/13 I+1
<i>Kobresia schoenoides</i> (C.A.Mey.)Steud.	.	.	.	.	.	.	II ⁺	.	.	IV ¹⁻²	3	.	3/13 II-IV+2,3
* <i>Galium boreale</i> L.	1/1	.	J/+	.	.	.	.	.	.	.	.	.	2/13 +1
* <i>Taraxacum</i> cf. <i>pseudo-stenolepium</i> v.Soest	+/r	.	J/+	.	.	.	.	.	.	.	.	.	2/13 r+
<i>Galium verum</i> L.	+/1	.	.	I ⁺	2/13 I+1,+1
* <i>Draba stenocarpa</i> Hook.f.et Th.	+/1	.	.	.	IV ^{r+}	.	.	.	.	.	.	.	2/13 IVr+1,+1
<i>Pedicularis pycnantha</i> Boiss.ssp. <i>typica</i> Pen.	.	+	+/.	.	.	.	.	.	.	.	.	.	2/13 +
<i>Astragalus oplites</i> Benth.	.	1	J/+	.	.	.	.	.	.	.	.	.	2/13 +1
<i>Potentilla desertorum</i> Bunge	.	+	J/+	.	.	.	.	.	.	.	.	.	2/13 +
<i>Geranium</i> cf. <i>regelii</i> Nevski	.	.	J/+	III ⁺	2/13 III+1
<i>Veronica lanosa</i> Royle ex Benth.	.	.	J2	II ^{r+}	.	.	.	.	.	.	.	.	2/13 +1,2
<i>Acantholimon lycopodioides</i> (Gir.)Boiss.	.	.	Jr	II ^{r+}	.	.	.	.	.	.	.	.	2/13 II+1,r
<i>Pulsatilla wallichiana</i> (Royle)Ulbr.	.	.	+/+	.	V ⁺²	.	.	.	.	.	.	.	2/13 V+2,+
<i>Potentilla argyrophylla</i> Wall.var. <i>leucochroa</i> Hk.f.	.	.	J/+	.	.	.	.	.	.	.	.	J/+	2/13 +
<i>Androsace robusta</i> (Kunth)Hd.-Mzt.ssp. <i>robusta</i>	.	.	.	III ¹⁻²	V ⁺²	.	.	.	.	.	.	.	2/13 III-V+2
<i>Draba tibetica</i> Hk.f.et Th.var. <i>tibetica</i> Jafri	.	.	.	I ⁺	IV ^{r+}	.	.	.	.	.	.	.	2/13 I-IV+2
<i>Lonicera asperifolia</i> (Dcne.)Hook.f.et Th.	.	.	.	I ⁺	.	II ⁺	2/13 I-IIr+
<i>Poa pratensis</i> L.ssp. <i>pruinosa</i> (Kor.)Dickoré	.	.	.	I ⁺	1	.	2/13 I1,1
<i>Tanacetum longifolium</i> Wall.ex DC.	.	.	.	I ⁺	1	2/13 I+1
<i>Rhodiola tibetica</i> (Hook.f.et Th.)Fu	.	.	.	.	II ⁺	II ⁺	2/13 II+
<i>Silene tenuis</i> Willd.	.	.	.	.	II ⁺	.	.	.	+	.	.	.	2/13 II+1
* <i>Salix karelinii</i> Turcz.	.	.	.	.	II ⁺	II ⁺	.	.	2/13 IIr-4
* <i>Gentiana moorcroftiana</i> Wall.	.	.	.	.	V ^{r+}	.	.	.	.	.	.	+/.	2/13 V+1,+1

Subalpine turf and steppe-meadow communities (W Ladakh)	Community of <i>Koeleria cristata</i> and <i>Stipa pennata</i> ssp. <i>kirghisorum</i>		Transitional zone betw. subalp. steppe and <i>Bistorta affinis</i> community	<i>Bistorta affinis</i> community-group		<i>Artemisia brevifolia</i> - <i>Cicer microphyllum</i> community	Community-group of <i>Festuca kashmiriana</i> and <i>Poa suruana</i>			Grassland dominated by <i>Carex melanantha</i>	Grassland dominated by <i>Carex pseudofoetida</i>	Grassland dominated by <i>Kobresia schoenoides</i> and <i>Agrostis vinealis</i>	Grassland dominated by <i>Kobresia royleana</i> and <i>Leontopodium leontopodium</i>
Serial number (nr.)	1	2	3	4	5	6	7	8	9	10	11	12	13
Table-nr. / Relevé-nr.	Tab.1	6	Tab.2	Tab.1	Tab.1	Tab.4	Tab.5	Tab.5	87	Tab.2	102	93	61/63
Number of relevés	2	1	2	5	3	6	7	2	1	3	1	1	2
Altitude in m (a.s.l.) x 10	355/345	337	354	358-387	406-416	391-419	388-417	434/438	419	419-430	364	405	388/403
Cover (Ø) in %	80/95	50-60	65/80	81	80	80	86.4	72.5	85	98.3	90	100	90/85
pH of rhizosphere (Ø) / effective	5,4(3)	6	5,3(2)	5,6(2)	6,1(2)	5,7(3)	5,1(3)	-	5.0	4,3(2)	5.3	4.5	5.6
Number of taxa (Ø) / effective	37/30	23	21/30	23	32.7	19.7	17.9	19	26	13.7	12	24	16/17
Areas in Ladakh	<u>2</u>	<u>2</u>	<u>2</u>	<u>4.b.c</u>	<u>4.b</u>	<u>4.d</u>	<u>4.d</u>	<u>4.d</u>	<u>4.d</u>	<u>4.d</u>	<u>4.c</u>	<u>4.d</u>	<u>4.a</u>
Year of publication, 19..	83	83	83	90	90	87	87	87	87	90	87	90	90
<i>Festuca rubra</i> L.ssp. <i>arctica</i> (Hack.)Govar	-	-	-	-	IV*	-	-	-	-	-	-	-	1/2
<i>Kobresia royleana</i> (Nees)Boeck.	-	-	-	-	II*	-	-	-	-	-	-	-	4/4
* <i>Rosa</i> sp.	-	-	-	-	-	V*	I*	-	-	-	-	-	2/13 II+,4
* <i>Calamagrostis epigejos</i> (L.)Roth	-	-	-	-	-	IV ¹⁻²	V ³	-	-	-	-	-	2/13 I-V+
<i>Carex moorcroftii</i> Falc.ex Boott	-	-	-	-	-	I*	V ⁴⁻⁵	-	-	-	-	-	2/13 IV-V+3
<i>Bromus oxyodon</i> Schrenk	-	-	-	-	-	I*	I*	-	-	-	-	-	2/13 I-V+5
<i>Axyris hybrida</i> L.	-	-	-	-	-	I*	II ¹⁻¹	-	-	-	-	-	2/13 I+
<i>Arnebia euchroma</i> (Royle)J.M.Johnst.	-	-	-	-	-	II*	+/.	-	-	-	-	-	2/13 I-II+1
* <i>Brachyactis pubescens</i> (DC.)Aitch.	-	-	-	-	-	-	II*	-	-	-	-	+	2/13 II+,+
* <i>Rumex acetosa</i> L.	-	-	-	-	-	-	I*	-	-	-	-	1	2/13 I+,1
* <i>Carex melanantha</i> C.A.Mey.	-	-	-	-	-	-	-	-	1	V ⁵	-	-	2/13 II+,+
* <i>Selinum papyraceum</i> C.B.Clarke	-	-	-	-	-	-	-	-	-	IV ¹	-	+	2/13 V5,1
* <i>Aconitum violaceum</i> Jacq.ex Stapf	-	-	-	-	-	-	-	-	-	IV ¹	-	2	2/13 IV1,+
<i>Sibbaldia cuneata</i> Kunze	-	-	-	-	-	-	-	-	-	-	2	-	2/13 IV1,2
* <i>Epilobium laxum</i> Royle	-	-	-	-	-	-	-	-	-	-	-	1	+/+
* <i>Pedicularis kashmiriana</i> Pennell	1/1	-	-	-	-	-	-	-	-	-	-	-	2/13 +1
* <i>Hieracium prenanthoides</i> Vill.	1/+	-	-	-	-	-	-	-	-	-	-	-	1/13 1
* <i>Geranium pratense</i> L.ssp. <i>stewartianum</i> Y.Nas.	+1	-	-	-	-	-	-	-	-	-	-	-	1/13 +1
* <i>Tragopogon dubius</i> Scop.	+1+	-	-	-	-	-	-	-	-	-	-	-	1/13 +1
* <i>Iris hookeriana</i> Foster	+1r	-	-	-	-	-	-	-	-	-	-	-	1/13 +
<i>Elymus cognatus</i> (Hack.)Cope	1/.	-	-	-	-	-	-	-	-	-	-	-	1/13 r+
* <i>Carex plectobasis</i> V.Krecz.	1/.	-	-	-	-	-	-	-	-	-	-	-	1/13 1
<i>Aconogonon rumicifolium</i> (Royle)Hara	+/.	-	-	-	-	-	-	-	-	-	-	-	1/13 1
<i>Bupleurum thomsonii</i> C.B.Clarke	+/.	-	-	-	-	-	-	-	-	-	-	-	1/13 +
* <i>Elymus fedtschenkoi</i> Tzvel.	+/.	-	-	-	-	-	-	-	-	-	-	-	1/13 +
<i>Rosa webbiana</i> Wall.ex Royle	+/.	-	-	-	-	-	-	-	-	-	-	-	1/13 +
<i>Euphorbia thomsoniana</i> Boiss.	+/.	-	-	-	-	-	-	-	-	-	-	-	1/13 +
* <i>Berberis</i> sp.	r/.	-	-	-	-	-	-	-	-	-	-	-	1/13 +
* <i>Rochelia laxa</i> J.M.Johnst.	/1	-	-	-	-	-	-	-	-	-	-	-	1/13 r
* <i>Androsace aizoon</i> Duby var. <i>himalaica</i> Kbh.	-	+	-	-	-	-	-	-	-	-	-	-	1/13 1
* <i>Artemisia parviflora</i> Roxb.	-	+	-	-	-	-	-	-	-	-	-	-	1/13 +
* <i>Taraxacum</i> cf. <i>bicolor</i> DC.	-	+	-	-	-	-	-	-	-	-	-	-	1/13 +
* <i>Erysimum mellicentae</i> Dunn	-	+	-	-	-	-	-	-	-	-	-	-	1/13 +
* <i>Viola rupestris</i> F.W.Schm.	-	-	+1	-	-	-	-	-	-	-	-	-	1/13 +1
* <i>Gentiana borealis</i> Bunge	-	-	+1+	-	-	-	-	-	-	-	-	-	1/13 +
<i>Silene gonosperma</i> (Rupr.)Bocq.ssp. <i>himal.</i> Bq.	-	-	./+	-	-	-	-	-	-	-	-	-	1/13 +
<i>Poa</i> cf. <i>attenuata</i> Trin.	-	-	-	-	II ²	-	-	-	-	-	-	-	1/13 II2
<i>Tanacetum fruticosum</i> Ledeb.	-	-	-	-	II ¹	-	-	-	-	-	-	-	1/13 IIr
<i>Carex stenophylla</i> Wahlenb.	-	-	-	-	I*	-	-	-	-	-	-	-	1/13 I+
<i>Cousinia thomsonii</i> Clarke	-	-	-	-	I*	-	-	-	-	-	-	-	1/13 I+
<i>Jurinea ceratocarpa</i> Benth.var. <i>depressa</i> Cke.	-	-	-	-	I*	-	-	-	-	-	-	-	1/13 I+
* <i>Gentiana pedunculata</i> Royle ex D.Don	-	-	-	-	I*	-	-	-	-	-	-	-	1/13 I+
<i>Hieracium umbellatum</i> L.	-	-	-	-	II ¹	-	-	-	-	-	-	-	1/13 Ir
* <i>Euphrasia</i> sp.	-	-	-	-	-	V ²	-	-	-	-	-	-	1/13 V2
<i>Festuca olgae</i> (Regel)Krivot.	-	-	-	-	-	V ³	-	-	-	-	-	-	1/13 V+3
* <i>Pedicularis pectinata</i> Wall.	-	-	-	-	-	V ⁴	-	-	-	-	-	-	1/13 V+1
<i>Delphinium cashmerianum</i> Royle	-	-	-	-	-	V ⁴⁻¹	-	-	-	-	-	-	1/13 V+1
<i>Cerastium cerastioides</i> (L.)Britt.	-	-	-	-	-	V ⁴⁻¹	-	-	-	-	-	-	1/13 V+1
<i>Kobresia capillifolia</i> (Dcne.)Clarke	-	-	-	-	-	IV ¹⁻²	-	-	-	-	-	-	1/13 IV1-2
* <i>Lomatogonium coeruleum</i> (Royle)H.Sm.	-	-	-	-	-	IV ⁴⁻¹	-	-	-	-	-	-	1/13 IV+1
<i>Oxytropis humifusa</i> Kar.et Kir.	-	-	-	-	-	IV*	-	-	-	-	-	-	1/13 IV+
* <i>Carex stenocarpa</i> Turcz.ex Krecz.	-	-	-	-	-	II ²	-	-	-	-	-	-	1/13 II2
<i>Silene moorcroftiana</i> Wall.	-	-	-	-	-	II*	-	-	-	-	-	-	1/13 II+
<i>Kochia prostrata</i> (L.)Schrud.	-	-	-	-	-	-	IV ⁴⁻¹	-	-	-	-	-	1/13 IV+1
<i>Heracleum pinnatum</i> C.B.Clarke	-	-	-	-	-	-	IV ⁴⁻¹	-	-	-	-	-	1/13 IVr+
* <i>Cotoneaster uniflora</i> Bunge	-	-	-	-	-	-	I ¹	-	-	-	-	-	1/13 I1
<i>Verbascum</i> cf. <i>thapsus</i> L.	-	-	-	-	-	-	I*	-	-	-	-	-	1/13 I+
<i>Artemisia wellbyi</i> Hemsl.et Pears.	-	-	-	-	-	-	I*	-	-	-	-	-	1/13 I+
<i>Sisymbrium brassiciforme</i> C.A.Mey.	-	-	-	-	-	-	I*	-	-	-	-	-	1/13 Ir
* <i>Hylotelephium ewersii</i> (Led.)H.Ohba	-	-	-	-	-	-	I*	-	-	-	-	-	1/13 I+
* <i>Equisetum ramosissimum</i> Desf.	-	-	-	-	-	-	I*	-	-	-	-	-	1/13 I+
<i>Potentilla bifurca</i> L.	-	-	-	-	-	-	-	-	-	-	2	-	1/13 2
<i>Lomatogonium carinthiacum</i> (Wulf.)A.Br.	-	-	-	-	-	-	-	-	-	-	-	1	1/13 1

Subalpine turf and steppe-meadow communities (W Ladakh)	Community of <i>Koeleria cristata</i> and <i>Stipa pennata</i> ssp. <i>kirghisorum</i>		Transitional zone betw. subalp. steppe and <i>Bistorta affinis</i> community	<i>Bistorta affinis</i> community-group		<i>Artemisia brevifolia</i> - <i>Cicer microphyllum</i> community	Community-group of <i>Festuca kashmiriana</i> and <i>Poa suruana</i>			Grassland dominated by <i>Carex melananthia</i>	Grassland dominated by <i>Carex pseudofoetida</i>	Grassland dominated by <i>Kobresia schoenoides</i> and <i>Agrostis vinealis</i>	Grassland dominated by <i>Kobresia royleana</i> and <i>Leontopodium leontopodium</i>	
Serial number (nr.)	1	2	3	4	5	6	7	8	9	10	11	12	13	
Table-nr. / Relevé-nr.	Tab.1	6	Tab.2	Tab.1	Tab.1	Tab.4	Tab.5	Tab.5	87	Tab.2	102	93	61/63	
Number of relevés	2	1	2	5	3	6	7	2	1	3	1	1	2	
Altitude in m (a.s.l.) x 10	355/345	337	354	358-387	406-416	391-419	388-417	434/438	419	419-430	364	405	388/403	
Cover (Ø) in %	80/95	50-60	65/80	81	80	80	86.4	72.5	85	98.3	90	100	90/85	
pH of rhizosphere (Ø) / effective	5,4(3)	6	5,3(2)	5,6(2)	6,1(2)	5,7(3)	5,1(3)	-	5.0	4,3(2)	5.3	4.5	5.6	
Number of taxa (Ø) / effective	37/30	23	21/30	23	32.7	19.7	17.9	19	26	13.7	12	24	16/17	
Areas in Ladakh	<u>2</u>	<u>2</u>	<u>2</u>	<u>4.b.c</u>	<u>4.b</u>	<u>4.d</u>	<u>4.d</u>	<u>4.d</u>	<u>4.d</u>	<u>4.d</u>	<u>4.c</u>	<u>4.d</u>	<u>4.a</u>	
Year of publication, 19..	83	83	83	90	90	87	87	87	87	90	87	90	90	
* <i>Primula denticulata</i> Smith	.	.	.	.	.	.	.	.	.	.	.	1	.	1/13 1
* <i>Sagina saginoides</i> (L.)Karst.	.	.	.	.	.	.	.	.	.	.	.	1	.	1/13 1
* <i>Stellaria cf. montioides</i> Ghaz.	.	.	.	.	.	.	.	.	.	.	.	+	.	1/13 +
* <i>Saussurea candoleana</i> (Wall.ex DC.)Clarke	.	.	.	.	.	.	.	.	.	.	.	+	.	1/13 +
* <i>Cystopteris dickieana</i> R.Sim.	.	.	.	.	.	.	.	.	.	.	.	+	.	1/13 +
* <i>Arabis tenuirostris</i> Schulz	.	.	.	.	.	.	.	.	.	.	.	+	.	1/13 +
* <i>Botrychium lunaria</i> (L.)Sw.	.	.	.	.	.	.	.	.	.	.	.	r	.	1/13 r
* <i>Bistorta vivipara</i> (L.)S.F.Gray	.	.	.	.	.	.	.	.	.	.	.	.	2/+	1/13 +2
* <i>Gentiana leucomelaena</i> Maxim.	.	.	.	.	.	.	.	.	.	.	.	.	+/+	1/13 +
* <i>Inula rhizocephala</i> Schr.var. <i>rhizocephaloides</i> Kt.	.	.	.	.	.	.	.	.	.	.	.	.	+/+	1/13 +
* <i>Parnassia laxmannii</i> Pallas ex Schult.	.	.	.	.	.	.	.	.	.	.	.	.	+/+	1/13 +
* <i>Swertia thomsonii</i> Clarke	.	.	.	.	.	.	.	.	.	.	.	.	+/.	1/13 +
* <i>Gentiana carinata</i> Griseb.	.	.	.	.	.	.	.	.	.	.	.	.	+/.	1/13 +
* <i>Salix flabellaris</i> Andersson	.	.	.	.	.	.	.	.	.	.	.	.	+/.	1/13 +
* <i>Anaphalis triplinervis</i> (Sims.)Clarke	.	.	.	.	.	.	.	.	.	.	.	.	./+	1/13 +
* <i>Plantago himalaica</i> Pilger	.	.	.	.	.	.	.	.	.	.	.	.	./+	1/13 +
* <i>Potentilla multifida</i> L.	.	.	.	.	.	.	.	.	.	.	.	.	./r	1/13 r

* species listed only in this table

7.4 Steppe and semidesert communities of the alpine belt (Table 4)

Since field work in the W and SW of Ladakh in the higher alpine belt (above 4500 m a.s.l.) was not possible anymore, an exact statement on the course of the upper borderline of the vegetation in these areas cannot be made. Coming from the western part, the first relevé of a stand was made at around 4500 m a.s.l. in the region of the Indus Valley next to Lardo and Alchi Brok (nr. 2, Table 4). The standard area with a cover of 70 % and 23 different species per relevé area lies almost 1500 m above the River Indus. Since in these steppes on coarse rock debris very often *Aconogonon tortuosum* or *Nepeta glutinosa* are the dominating species, such mountain slopes at high altitudes are often covered by a bright green shimmer. Within the investigated vegetation belt the species number tends to increase with increasing altitude. This equally holds true up to at least around 4500 m a.s.l. for the cover value.

Besides the naming species, among the most striking representatives of the *Aconogonon tortuosum* – *Nepeta glutinosa* – community (nr.1) are – both in relation to the cover-abundance and in relation to the steadiness – *Elymus canaliculatus*, *Thermopsis inflata* and *Lindelofia stylosa*. Within the alpine belt only in this community found were the following taxa: *Oxytropis mollis*, *Minuartia kashmirica*, *Senecio dubius*,

Sisymbrium brassiciforme, *Elymus cognatus*, *Thymus linearis* and *Lonicera heterophylla*. At present, it is not known whether above the alpine steppe on coarse rock debris on an appropriate soil some sort of grassland community is still formed.

From the mountains further to the east, situated approximately on the geographical longitude of Leh between the Indus- and the Markha Valley, originate the relevé lists, which contain the community-group of the alpine steppes with *Elymus canaliculatus* and *Potentilla bifurca* (nr. 3 and 4, Table 4). These steppes of the lower alpine belt are rather characteristic for the more central mountain areas of Ladakh. In these valleys the plant cover is exposed for a prolonged period of the year to extreme temperature conditions, strong winds, dry air and dry soil, but also strong solar radiation, as compared to the conditions at a similar altitude further to the west. The scarcity of precipitation in winter being rather more pronounced, the vegetation at high altitudes is only protected by a thin and sometimes interrupted snow cover resulting from the low temperatures.

Within the association-group of *Elymus canaliculatus* and *Potentilla bifurca* two communities can easily be distinguished: one with dominating *Acantholimon lycopodioides* (nr. 3) and one with dominating *Artemisia gmelinii* (nr. 4). Besides a striking difference in the species combination, the difference in the species number is not less noteworthy. The *Acantholimon lycopodioides*-community contains on the average per standard area at least six species more as compared with the *Artemisia gmelinii*-steppe; the cover value on the other hand is only about 10 % higher.

The *Acantholimon* – steppe covers large areas at higher altitudes (between around 4300 and 4700 m a.s.l.) of a side valley, which empties into the Indus Valley near Matho. This vegetation forms part of an important summer pasture for herds of dzos and for sheep and goats of the inhabitants of Matho (Matho Phu). Besides the generally dominating *Acantholimon lycopodioides*, especially *Artemisia stricta*, *Oxytropis humifusa*, *Ephedra gerardiana*, *Arabis tibetica* and most likely also *Astragalus oplites* belong to the characteristic group of differential species. Above around 4700 – 4800 m this remarkable steppe is followed by intermittent vegetation on coarse rock debris. Scarce formation of grassland at the high alpine belt is only very locally evident at sites of higher water content. On bare rock and on coarse rock debris low shrubs of the spiny *Caragana versicolor* can be found.

At slopes exposed to the W or to the N and in depressions the dense cushions of *Acantholimon* are generally lacking. Instead a shallow grassland significantly poorer in species and in which *Koeleria cristata* is able to become especially dominating (s. Tab. 6, 1987) grows. Presumably even in these snow poor regions, there are strong local snow depositions by wind during winter time and, as a consequence, slopes exposed to the north and to the west, but also depressions remain covered by snow for a longer period. Plants at these sites gain for a longer period by the melting water as compared to the normal *Acantholimon*-steppe. In favor of this hypothesis is the presence of moss species at these sites which are lacking in the investigated stands of *Acantholimon*, but which are also present in stands of *Caragana versicolor*.

In the same way as *Acantholimon* dominates physiognomically in the community bearing its name, the second community is dominated by *Artemisia gmelinii* (nr. 4, Table 4). The five relevés of this Wormwood- steppe from the lower alpine belt originate from the region of the Kanda La, a pass around 30 km to the W of Matho Phu, which links the southern side-valley of the River Indus near Yurutse with the Markha Valley. Even if the soil profile with coarse rock debris in the Kanda La– region is similar but not equal to the ones at Matho Phu, it remains questionable, whether soil factors alone are responsible for the difference between the two communities (s. 1987, p. 306/307).

This alpine steppe strikes at first by a throughout high cover-abundance of *Artemisia gmelinii*. Moreover, differential species in the true sense are lacking. Furthermore, a clear difference to the *Acantholimon*-steppe is made by an almost complete absence of the group of differential species from the *Acantholimon*-community. As a consequence, the species number per relevé area is on the average strongly reduced. To the north of the Kanda La, the *Artemisia gmelinii*-steppe is the predominant community on the consolidated soils from coarse rock debris of the alpine belt. Smaller and greater groups of the low growing *Caragana versicolor*-shrubs on solid rock and on rock debris interrupt this dominating steppe vegetation occasionally. Throughout this community the influence of grazing domestic animals can be detected, especially by herds of dzos.

From the high altitudes at Stok (Stok Phu) and Stok La up to Rumbak originate the nine relevés, which summarize the community-group with *Elymus canaliculatus* and *Arabis tibetica* (nr. 5). This species poor steppe on coarse rock debris represents above 4500 m up to 4850 m the most noteworthy community of the sparse plant cover. On the average per standard area of 100 – 150 m², there are just seven species (5 – 10). Also the average cover value is only at 30.6 % (15 – 45 %). Simply on the basis of the dominating *Biebersteinia odora* and *Thermopsis inflata*, which almost exclude each other, two communities or “variants” can be distinguished. With a presence degree of 50 to 100 %, only the two naming taxa (of the community-group!) are present in both variants. Besides *Biebersteinia Poa sterilis* and *Artemisia gmelinii* appear to be the differential species for variant I, *Urtica hyperborea*, *Potentilla bifurca* and *Dracocephalum heterophyllum* with *Thermopsis inflata* appear to be the ones of variant II.

In variant I, red and greenish, clay-rich shales but also green-grey and red sandstones form a silt-rich detritus layer, which is up to the surface either compact or looser and in the latter case sliding. *Biebersteinia* roots primarily in consolidated detritus or at sites where pure rock or rock debris have been covered by detritus.

At the relevé sites of variant II with *Thermopsis inflata* and *Urtica hyperborea* there are always shales, often of a dark brownish, more rarely of a greyish-greenish colour the basis for the detritus forming rocks.

In the catchment area of Stok Phu on well consolidated soil from mixed detritus, not rarely *Urtica hyperborea* prevails. On the steep slopes formed by red rock debris of slates at high altitudes from the Stok La to the E up to the valley of Stok Phu, *Aconogonon tortuosum* is the most striking plant. The rock debris in this area originates from the stratified rock. At slightly lower altitudes, but on the same detritus, *Astragalus*

munroi, *Festuca olgae* and *Potentilla ambigua* were growing. The latter and *Valeriana himalayana* as well as *Marmoritis rotundifolia* were found only once and exclusively in this community. An exactly equal species combination as in relevé Nr. 9, Tab. 8 (1987) was found on the other side of the pass exposed to the W but only next to the same stratified rock of wine-red shales. With the numerous low growing plants and a mean cover of 30% the described community-group presents an extremely sparse plant cover of the higher alpine belt. Nevertheless, even in the most remote side valleys the meager pasture is used by domestic animals such as dzos and domestic yaks (Photo 22, 1987).

From the close and remote surroundings of Tchatchutse in the far Markha Valley (Abb. 5, 1990) originate the six relevés, which cover the alpine steppe with *Stipa breviflora* and *Tanacetum fruticosum* between 4350 and 4600 m a.s.l. (nr. 6, Table 4). The course of the upper boundary of the steppe in that part of the main valley is not clearly visible, for the mainly rocky terrain at higher altitudes support neither the growth of steppe vegetation nor of grassland. From our own experience, we know that at the transition into the eastern valley of Nimaling the alpine steppe above around 4700 m is gradually replaced by the grassland community-group with *Poa attenuata* and *Potentilla pamirica*.

The characteristic species group of this alpine steppe vegetation includes besides *Stipa breviflora* and *Tanacetum fruticosum* also *Allium przewalskianum*. The following species might further underline the affiliation to a community- group of a higher level (alliance? order?): *Krascheninnikovia*, *Potentilla bifurca*, *Euphorbia tibetica*, *Oxytropis microphylla*, *Artemisia gmelinii* and *Elymus canaliculatus*.

Based on both investigations in three relevé areas and the very similar nature of the topsoil in the alpine steppe of the region of Tchatchutse a significant carbonate content can be expected everywhere. However, whether it is only petrographically–geologically determined or rather as a result of real soil conditions i.e. by the hydrolysis of silicates with subsequent carbonatization remains questionable. At this altitude of the Markha Valley both possible causes have to be considered. Without doubt, the alpine steppe with *Stipa breviflora* and *Tanacetum fruticosum* is used everywhere by domestic animals, despite their little productivity.

With the 23 relevés of the alpine desert-steppe between 4550 m and 4880 m a.s.l. (nr. 7 und 8, Table 4) an area is covered, which reaches from Tsakenama on the N side of the Taglang La to its S side, and going over Debring to the Tso Kar and the More Plaine up to Norbo in Rupshu (Abb. 1, 1997). The transition in the structure and in the floristic composition at the ascent to the desert-steppe at the N slopes of the Taglang La is reflected in the first relevés of Table 1 (HARTMANN, 1997). In the field, the transition is barely noticeable and takes place gradually over an altitude of at least 200 m. The high Taglang La pass acts for some species as a “floristic boundary “, less striking though also as vegetation limit e.g. within the alpine desert-steppe between the N to NW regions and the S to SE of Rupshu (s. nr. 7 and 8, Table 4). Among the species, which have their main distribution to the south and to the east of the Taglang La is *Stipa caucasica* ssp. *glareosa*. As peculiarity, it can already be found in some relevés of the desert-steppe on the N slopes of the pass between 4700 and 4880 m a.s.l. In a stand of the high alpine steppe with *Artemisia minor* and *Potentilla pamirica* the

stipa had even been noted – albeit it was inconspicuous – at least two kilometers to the N of the pass at 5200 m a.s.l.. Regarding *Stipa glareosa* it is also noteworthy that it reaches dominance in numerous stands only to the south and south-east of the Taglang La. Further exponents of the steppe, which have only been recorded at Rupshu, i.e. to the SE of the pass, include *Stipa subsessiliflora*, *Marrubium marrubiastrum* and the annual *Polygonum molliaeforme*. To the group of species whose distribution ends coming from the N and from the W at the Taglang La (i.e. which have not been found in Rupshu anymore) belong among others *Tanacetum fruticosum*, *Christolea crassifolia*, *Elymus nutans* and *Poa sterilis*.

Depending on the dominance of either grass-like species or dwarf-shrubs, differences between communities can already be recognized based on the physiognomy. So the desert-steppe as a community on the N-facing slopes of the Taglang La is characterized in at least $\frac{2}{3}$ of the relevés by the dominance of Chamaephytes. At lower altitudes this can be *Tanacetum fruticosum*, above 4600 m namely *Artemisia gmelinii* and *Artemisia minor*, more rarely *Krascheninnikovia*. At the sites in Rupshu often *Stipa caucasica* ssp. *glareosa* attracts notice for its abundance, more rarely it is replaced by *Carex stenophylla*. In the Tso Kar basin, *Stipa subsessiliflora* is added to this group and on wide areas *Leymus secalinus* covers significant patches. From Debring to Norbo, the desert-steppe again and again prevails on large areas by *Krascheninnikovia*.

The different character of the landscape on both sides of the Taglang La is also reflected in the differences about the incline of community A and B, which on the average of the 9 stands (nr. 7) is doubled on the northern side of the pass (24.4°) as compared to the 14 relevé areas on the S-side at Rupshu (where on the average the incline is 9.6°)! Regarding the mean vegetation cover of almost $\frac{1}{3}$, no significant differences exist, but the species number per sample plot is on the average for community A with 10.8 (8 – 15) by 3 higher than for B (7.6; 5 – 10).

With the 12 relevés of nr. 9 (Table 4) the alpine steppe with *Potentilla bifurca* and *Artemisia gmelinii* in the area of the two high passes of the Ladakh Range, Khardung La and Chang La, is described; they lie around 35 to 40 km apart. The relevé areas on both sides of the passes lie in between 4440 and 4780 m a.s.l. The mean cover reaches around 50 %. Solely on the N-side of the Chang La at a comparable altitude, is it slightly below this value (40–45 %). The five relevés on the N-and S-slopes of the Khardung La contain on the average 18 species (15–22) per stand. At the Chang La, on the S-facing side 15.7 (14 – 18) and on the N-side only 11.2 (9–15) species were recorded, most likely a further sign of increasing aridity towards the east and southeast.

Common taxa to both pass regions on both the N- and S-side are only five: besides the named *Potentilla* and *Artemisia* *Astragalus oplites*, *Euphorbia tibetica* and *Acantholimon lycopodioides* belong to them. Only at the Khardung La repeatedly found were *Psychrogeton andryaloides* var. *andryaloides*, *Astragalus strictus*, *Festuca alaica* and *Leontopodium leontopodium*. Only on the N-side of the same pass noted were *Elymus jacquemontii* and *Poa attenuata*. *Carex moorcroftii*, *Poa sterilis* and *Androsace robusta* appear to be limited to the S-side of the Chang La. From the S-facing side of both passes only *Polygonum polycnemoides* / *rottboellioides* need to be mentioned specifically, from the N-side of both passes *Krascheninnikovia pungens*. *Ptilotrichum canescens* and *Tanacetum fruticosum* were recorded only in relevés at the N-side of the Chang

La. Everywhere present, but lacking on the N-side of the Chang La: *Eritrichium canum*, *Nepeta discolor* and *Piptatherum gracile*.

In vertical direction, this alpine steppe represents the succeeding vegetation following on the described desert-steppe. Ascending at the S-side of the Khardung La, at a level of 4400 m at the latest the alpine steppe is reached. The transition into the loose grassland at high altitude with *Poa attenuata* and *Potentilla pamirica* hardly takes place below 4700 m a.s.l. At the S-slope of the Chang La in the region above Sakti, for the alpine steppe a similar course has to be taken. At the N-side of the pass in the direction to the valley of Tangtse the plant cover is more different compared to the one on the northern side of the Khardung La. Here the mountain desert penetrates far over 4000 m a.s.l. into the valley of Tsoltak. Below 4500 m, even at areas exposed to the north, a somewhat typical alpine steppe cannot be expected at all. The upward transition into loose grassland with *Poa attenuata* and *Potentilla pamirica* takes place in the valley of Tsoltak only at an altitude of around 4900 m. Detailed informations on the alpine steppe of the Ladakh Range can be found in HARTMANN (1999, p. 185).

An impression of the desert vegetation at the transition zone to the alpine belt at the north-eastern edge of the Ladakh Range is reflected in the seven stands of variant A of the community with *Stipa glareosa* and *Krascheninnikovia pungens* in Table 4 (1999). Table 4 of that paper contains (as variant B) two further relevés which give an impression of the desert-like vegetation from the alpine belt at the Tso Moriri, a region which lies at least 120 km further to the south!

At the NE-slopes of the Chang La, the desert with the characteristic species composition reaches up to an altitude of around 4300 m. The transition into the alpine desert-steppe or steppe takes place over an altitude range of around 200 m. This transition zone gradually ascends towards the E and SE. Therefore, the vertical extension of the desert is expanded in the same direction; the desert gains more and more room at the cost of the desert-steppe and the steppe. At the Pangong Tso, the picture of the all dominating alpine desert is finally reached. From the shore (at around 4250 m a.s.l.) upwards, nowhere not even a tinge of green can be seen, with the exception of the rather rare water containing sites. At the northwest end, at the closer and more remote surrounding of the lake few, already mentioned representatives of the mountain desert grow, very sparse and separated from each other to an extent that a real relevé becomes pointless.

The landscape at the Tso Moriri is not less desert-like. The two relevé areas Nr. 8 and 9 in Table 4 (1999) lie to the W and NW above Karzok. They represent the western catchment of the Tso Moriri. It needs to be added that both areas were selected based on the relatively “lush” vegetation! In the further surroundings, even at higher altitudes, a decision for additional relevés could not be made anymore, as the cover degree did not attain 5 % and on an area of 150 m² in the best case 2 – 3 species could be found.

On the average on a standard area of at least 150 m² hardly 8 species are present (7.7), which equals the species number of the alpine desert-steppe with *Krascheninnikovia* and *Ptilotrichum canescens*, as far as only variant B to the S of the Taglang La is considered. Nevertheless, the mean cover value of the specified variants (B₁ and

B₂) attains with 31.8% the double value compared with the mountain desert (14.4%), at least if for once Nr. 7 in Tab. 4 (1999) as a stand at the transition to the alpine steppe is not considered. The mountain desert with *Krascheninnikovia pungens* and *Stipa glareosa* belongs to the most species-poor communities of Ladakh.

Whilst surveying on the one hand the regions to the SE of the Taglang La up to the Tso Kar and the More Plain to Pang with a comparison of the N and NW borderland of the Tso Moriri and on the other hand the N and NE valleys of the Chang La towards the E with a comparison of the NW borderlands of the Pangong Tso, the assumption that the alpine desert-steppe becomes an alpine desert towards the SE and E with only a minor change in the species composition, is corroborated. Presumably the community with *Stipa glareosa* and *Krascheninnikovia* continues further up to W Tibet. The short description of an Ajanía (= *Tanacetum*) fruticulosa community by WANG JIN-TING (1988) in addition substantiates this assumption. Accordingly, the community on gravel and detritus in the valley of the River Gar and in the lower mountains at the eastern edge of the Pangong Tso between 4250 and 4600 m a.s.l. is widely distributed. With a total cover value of 10 – 20%, 7 species are enumerated, which are also included without exception in Tab. 4 (1999). Limited to this Table are *Halogeton arachnoideus* and *Corispermum tibeticum*.

A further relationship to the Tibetan highland in the east – both in a floristic and in ecological respects – is facilitated by the alpine steppe with *Stipa purpurea* and / or *Carex moorcroftii* (nr. 11, Table 4). The 7 relevés are distributed from the Kiagar La to the edge of the depression at the Kiagar Tso and are to be found at an altitude from 4720 to 4800 m a.s.l., s. (1999, Tab. 5). The stand in the plain of the Kiagar La is interesting from a floristic point of view, since two species are present, namely *Astragalus heydei* and *Hypocymus leptocarpum*, which elsewhere had not been found within Ladakh neither within nor outside of a relevé. To these two species must be added *Artemisia stracheyi* Hook.f. et Th, which is lacking on the investigated relevé area but which in the closer surroundings had been found everywhere on stony grounds. According to ZHENG DU (1983) probably all three species in common with the characteristic *Carex moorcroftii* and *Stipa purpurea* belong to the Tibetan flora- or geoelement.

The community with *Stipa purpurea* and *Carex moorcroftii* may be viewed as a form of the cold steppe or “high-cold steppe” according to WANG JIN-TING (1988), which is widely distributed in Tibet. The author differentiates within the “high-cold steppe” four communities, among which the “*Stipa purpurea* community” comes closest to the alpine steppe at the Kiagar Tso. Among the 15 mentioned species, 9 are included in Tab. 5 (1999) or in nr. 11, Table 4, among them important species such as *Stipa purpurea*, *Carex moorcroftii*, *Oxytropis microphylla*, *Stipa roborovskii* and *Oxytropis tatarica*.

Besides the group of characteristic taxa with *Stipa purpurea*, *Carex moorcroftii* and *Stipa roborovskii*, *Ptilotrichum canescens*, *Oxytropis microphylla*, *Euphorbia tibetica* and *Leymus secalinus* might also be included in the characteristic species combination due to the high or highest presence degree.

In Table 5 (1999), a differentiation in two groups is recognizable as far as the figures 1 – 4 contain a number of species, namely *Dracocephalum heterophyllum* and the consecutive six species, which lack in the other five

relevés Nr. 5 – 7. In contrast to the other relevés, the latter three lay in almost horizontal areas. Could this be the cause of the difference in the species composition?

The fact that at the NW edge of the Tso Moriri as in the catchment of Karzok at comparable altitude instead of alpine steppe-desert-like conditions predominate, indicates even lower precipitation rates for these regions. Although at the time of the field work neither animals nor humans were met, distinct signs indicated the occasional presence of shepherds who, in the alpine steppes and semi-deserts, keep mainly Pashmina – goats, often in large herds.

Table 4

Steppe and semidesert communities of the alpine belt	Aconogonon tortuosum- Nepeta glutinosa community		Community-group of Elymus canaliculatus and Potentilla bifurca		Community-group of Elymus canaliculatus and Arabis tibetica	Community of Stipa breviflora and Tanacetum fruticosum	Community-group of Krascheninnikovia ceratoides / Ptilotrichum canescens		Community-group of Potentilla bifurca / Artemisia gmelinii	Stipa glareosa- Krascheninnikovia ceratoides community	Stipa purpurea-Carex moorcroftii community	Succession stage of Artemisia wellbyi
Serial number (nr.)	1	2	3	4	5	6	7	8	9	10	11	12
Table-nr. / Relevé-nr.	Tab.5	37	Tab.6	Tab.6	Tab.8	Tab.5	Tab.1	Tab.1	Tab.2	Tab.4	Tab.5	316
Number of relevés	5	1	10	5	9	6	9(A)	14(B)	12	9	7	1
Altitude in m (a.s.l.) x 10	405-426	446	431-470	450-459	455-482	434-459	455-488	460-483	444-478	410-470	472-480	425
Cover (Ø) %	60	70	53	44	30.6	45.8	29.4	31.8	46.3	17.2	42.8	15
pH of rhizosphere (Ø) / effective	7,1(4)	6.6	6,5(3)	7,4(3)	7,0(4)	7,5(3)	7,7(4)	7,6(8)	7,2(8)	8,0(6)	6,9(2)	-
Number of taxa (Ø) / effective	16.8	23	15.5	9.2	6.9	10.7	10.8	7.6	15.2	7.7	11	9
Areas in Ladakh	<u>9</u>	<u>9</u>	<u>13</u>	<u>13</u>	<u>13</u>	<u>14</u>	<u>15</u>	<u>16</u>	<u>12, 19, 20</u>	<u>18, 20</u>	<u>17, 18</u>	<u>20</u>
Year of publication, 19..	83	83	87	87	87	90	97	97	99	99	99	99
Potentilla bifurca L.	I ⁺	1	V ¹⁻²	V ¹⁻²	II ¹⁻²	V ¹⁻²	III ¹⁻¹	I ¹⁻²	V ¹⁻²	.	II ¹⁻¹	.
Poa sterilis M.Bieb.	II ¹⁻¹	1	.	II ¹⁻²	II ¹⁻¹	IV ¹⁻¹	II ²	I ¹⁻²	I ¹⁻²	I ¹	.	10/12 I-V+2,1
Artemisia gmelinii Web.ex Steckm.	III ¹⁻²	.	III ¹⁺	V ³	II ¹⁻¹	IV ¹⁻³	V ¹⁻³	+	V ¹⁻³	.	II ¹	9/12 I-IV+2,1
Euphorbia tibetica Boiss.	II ⁺	.	IV ¹⁻²	III ⁺	.	IV ¹⁻¹	IV ⁺	I ¹⁺	IV ¹⁻²	II ⁺	V ¹⁻²	9/12 +Vr-3
Dracocephalum heterophyllum Benth.	.	.	III ¹⁻¹	II ⁺	III ¹⁻¹	III ¹⁻¹	III ¹⁻¹	+	II ¹⁻²	I ⁺	III ¹⁻¹	9/12 I-Vr-2
Krascheninnikovia ceratoides (L.)Gueld.	.	.	III ¹⁻¹	IV ¹⁻²	.	V ¹⁻³	IV ¹⁻²	V ¹⁻³	III ¹⁻³	V ¹⁻²	III ⁺	8/12 III-Vr-3
Oxytropis microphylla (Pallas)DC.	.	.	II ¹⁻²	II ⁺	.	V ¹⁻¹	IV ¹⁻²	V ¹⁻¹	III ¹⁻²	III ¹⁻¹	V ¹⁻²	8/12 II-Vr-2
Elymus canaliculatus (Nevski)Tzvel.	V ¹⁻²	1	V ¹⁻¹	V ¹⁻²	V ¹⁻¹	I ⁺	.	.	I ¹⁻¹	.	.	7/12 I-V+2,1
Androsace robusta (Kth.)Hd.-Mzt.ssp.robusta	II ⁺	+	+	I ⁺	.	I ⁺	.	.	I ¹⁻¹	.	.	6/12 +II-1+,1
Nepeta discolor Royle ex Benth.	I ⁺	1	II ⁺	I ⁺	III ¹⁻²	.	III ¹⁻²	6/12 I-IIIr-2,1
Aconogonon tortuosum (D.Don)Hara	V ¹⁻⁴	1	.	.	III ¹⁻³	.	II ¹⁺	.	.	.	I ⁺	2
Ptilotrichum canescens (DC.)C.A.Mey.	.	.	.	.	.	II ⁺	IV ¹⁻²	IV ¹⁻²	II ¹⁻¹	III ¹⁻²	V ¹⁻²	6/12 II-Vr-2
Arabis tibetica Hook.f.et Th.	IV ¹⁻²	.	IV ¹⁻¹	.	IV ¹⁻²	.	I ⁺	.	+	.	.	5/12 +IV+2
Acantholimon lycopodioides Boiss.	II ¹⁻²	.	V ¹⁻³	III ¹⁺	I ¹	.	.	.	III ¹⁻³	.	.	5/12 I-Vr-3
Crepis flexuosa Benth.et Hook.f.	III ¹⁺	.	+	.	.	.	I ⁺	.	.	II ¹⁻¹	.	1
Ephedra gerardiana Wall.ex Stapf	.	+	IV ¹⁻²	I ⁺	I ⁺	.	.	.	+	.	.	5/12 +IVr-2,+
Potentilla sericea L.(inkl.P.aphanes Soják)	.	+	II ¹⁻¹	.	.	III ¹⁺	I ⁺	.	II ¹⁻³	.	.	5/12 I-III+3,+
Caragana versicolor Benth.	.	.	I ¹⁺	III ¹⁺	.	II ¹	II ⁺	II ¹⁻²	.	.	.	5/12 I-IIIr-2
Poa attenuata Trin.	.	.	II ¹⁻²	.	I ¹	.	II ⁺	+	II ¹⁻²	.	.	5/12 +II+2
Tanacetum fruticosum Ledeb.	.	.	.	.	.	V ¹⁻³	II ²⁻³	.	II ¹⁻³	IV ¹⁻³	.	+
Stipa caucasica Schmalh.ssp.glareosa Tzvel.	.	.	.	.	.	.	III ¹⁺	V ¹⁻³	III ¹⁻²	V ¹⁻²	I ⁺	5/12 I-Vr-3
Oxytropis tatarica Camb.ex Bge.	.	.	.	.	.	.	II ⁺	V ¹⁻²	+	II ¹⁻¹	III ¹⁺	5/12 +Vr-2
Elymus jacquemontii (Hook.f.)Tvel.	.	.	.	.	.	.	I ⁺	III ¹⁻²	II ¹⁻²	I ⁺	III ¹⁻²	5/12 I-III+2
* Thermopsis inflata Camb.	IV ¹⁻³	1	+	.	IV ¹⁻³	.	.	.	.	.	.	4/12 +IV+3,1
Lindelofia stylosa Brand	IV ¹⁻¹	+	+	.	.	.	.	.	+	.	.	4/12 +IV+1,+
Leontopodium leontopodium (DC.)Hnd.-Mzt.	I ¹	+	II ¹⁺	II ¹⁻²	.	.	4/12 I-IIIr-2,+
Eritrichium canum Kitam.	II ¹⁻²	.	IV ¹⁻¹	III ¹⁺	IV ¹⁻¹	.	.	4/12 II-IVr-2
Silene moorcroftiana Wall.	II ¹⁻¹	.	II ¹⁻¹	.	.	.	.	.	II ¹⁻¹	.	.	r
Oxytropis humifusa Kar.et Kir.	.	.	IV ¹⁻³	I ⁺	II ¹⁻¹	.	.	.	+	.	.	4/12 +IVr-3
Astragalus oplites Benth.	.	.	III ¹⁻¹	I ⁺	I ¹	.	.	.	IV ¹⁻²	.	.	4/12 I-IV+2
Carex stenophylla Wahlenb.	.	.	+	.	.	I ¹	.	+	I ¹	.	.	4/12 +I1
Christolea crassifolia Camb.	.	.	.	+	.	II ⁺	III ¹⁻²	.	.	IV ¹⁻¹	.	4/12 +IVr-2
Stipa breviflora Griseb.	.	.	.	.	.	V ¹⁻²	V ¹⁻³	.	+	I ²	.	4/12 +V1-3
Leymus secalinus Tzvel.	.	.	.	.	.	.	I ⁺	II ¹⁻³	I ⁺	.	V ¹⁻²	4/12 I-V+3
Artemisia wellbyi Hemsl.et Pears.	+	II ¹⁻²	I ³	2
Rheum tibeticum Maxim.	IV ¹⁺	.	+	.	I ⁺	4/12 +IIr-3,2
												3/12 +IVr+

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Number of taxa (Ø) / effective	16.8	23	15.5	9.2	6.9	10.7	10.8	7.6	15.2	7.7	11	9						
Areas in Ladakh	<u>9</u>	<u>9</u>	<u>13</u>	<u>13</u>	<u>13</u>	<u>14</u>	<u>15</u>	<u>16</u>	<u>12,19,20</u>	<u>18, 20</u>	<u>17, 18</u>	<u>20</u>						
Year of publication, 19..	83	83	87	87	87	90	97	97	99	99	99	99						
Koeleria cristata (L.)Pers.	II ⁺¹	.	I ¹⁻⁴	II ⁺¹	.	.	.	3/12 I-II+-4					
Festuca olgae (Regel)Krivot.	.	1	.	+	II ⁺	3/12 +-II+,1					
Festuca alaica Drobow.	.	1	+	II ⁺²	.	.	.	3/12 +-II+-2,1					
Psychrogeton andryaloides (DC.)Nov.var.andrya.	.	+	II ⁺¹	II ⁺²	.	.	.	3/12 II+-2,+					
Tanacetum tibeticum Hook.f.et Th.	.	.	+	.	II ⁺¹	.	I ¹	3/12 +-IIr-1					
Piptatherum gracile Mez	.	.	III ⁺¹	I ⁺	III ¹⁻³	.	.	.	3/12 I-III+-3					
Elymus nutans Griseb.	II ⁺	II ⁺	.	.	I ⁺	.	.	3/12 I-II+					
Chrysanthemum pyrethroides Fedtsch.	I ⁺	.	.	I ⁺	.	.	1	3/12 Ir+-,1					
Artemisia minor Jacq.ex Bess.	IV ⁺³	.	+	.	II ⁺²	.	3/12 +-IVr-3					
* Scrophularia dentata Royle	III ⁺²	.	.	II ⁺²	.	1	3/12 II-III+-2,1					
* Salsola jacquemontii Moq.	I ¹⁻¹	.	I ⁺	I ⁺	.	3/12 Ir-1					
Nepeta glutinosa Benth.	V ⁺³	3	2/12 V+-3,3					
Oxytropis mollis Royle	III ⁺¹	+	2/12 III+-1,+					
Arnebia euchroma J.M.Johnst.	I ¹	+	.	.	2/12 +-Irr					
Biebersteinia odora Steph.	.	1	.	.	III ²⁻³	2/12 III2-3,1					
Delphinium brunonianum Royle	.	+	.	.	II ¹⁺	2/12 IIr+-,+					
Thesium hookeri Hedrych	.	.	II ⁺	I ⁺	2/12 I-II+					
Taraxacum sp.	.	.	I ⁺	+	.	.	.	2/12 +-I+					
* Heteropappus semiprostratus Griens.	.	.	+	+	.	.	2/12 +					
Stipa orientalis Trin.	.	.	.	+	.	.	II ⁺¹	2/12 +-II+-1					
Allium przewalskianum Regel	III ⁺	.	.	I ¹⁻²	.	.	.	2/12 I-IIIr-2					
Polygonum molliaeforme Boiss.	II ⁺³	I ¹⁻²	.	.	.	2/12 I-II+-3					
Chenopodium pamaricum Jilin	I ¹⁻¹	.	.	I ¹	.	2/12 Ir+-1					
Chamaerhodos sabulosa Bunge	+	.	.	II ¹⁻¹	.	2/12 +-IIr-1					
Physochlaina praealta (Decne.)Miers	+	II ⁺	.	.	2/12 +-II+					
Stipa roborovskii Rosh.	+	.	V ⁺¹	.	2/12 +-V+-1					
Carex moorcroftii Falc.ex Boott	I ¹⁻²	.	IV ²⁻³	.	2/12 I-IV1-3					
Elymus schugnanicus (Nevski)Tzvel.	III ⁺²	.	.	+	2/12 III+-2,+					
Heracleum pinnatum C.B.Clarke	I ⁺	.	+	2/12 Ir+,+					
Minuartia kashmirica (Edgew.)Mattf.	IV ⁺¹	1/12 IV+-1					
Piptatherum laterale Roshev.	IV ⁺¹	1/12 IV+-1					
Senecio dubius Ledeb.	IV ⁺	1/12 IV+					
Sisymbrium brassiciforme C.A.Mey.	III ⁺³	1/12 III+-3					
Elymus cognatus (Hack.)Cope	III ⁺	1/12 III+					
Semenovia lasiocarpa (Boiss.)Manden.	II ⁺¹	1/12 II+-1					
Chenopodium karo (Murr)Aellen	II ⁺	1/12 II+					
Stachys tibetica Vatke	I ²	1/12 I2					
Bromus confinis Nees ex Steud.	I ⁺	1/12 I+					
Thalictrum foetidum L.	I ⁺	1/12 I+					
Astragalus munroi Benth.ex Bge.	I ¹	1/12 Ir					
Stellaria montioides (Edg.et Hook.f.)S.A.Ghaz.	+	1/12 +					
Carex pseudofetida Kük.	.	+	1/12 +					
Thymus linearis Benth.ssp.linearis J alas	.	+	1/12 +					
* Lonicera heterophylla Decne.	.	+	1/12 +					
Dasiphora dryadanthoides Juz.	.	+	1/12 +					
Artemisia stricta Edgew.	.	.	V ⁺³	1/12 V+-3					
Artemisia brevifolia Wall.	.	.	II ¹⁻³	1/12 II1-3					
Stipa cf. himalaica Roshev.	.	.	II ⁺¹	1/12 II+-1					
Lepidium apetalum Wild.	.	.	II ⁺	1/12 II+					
* Veronica uncinata Pennell	.	.	+	1/12 +					
Urtica hyperborea Jacq.	III ⁺	1/12 III+					
* Valeriana himalayana Grub.	I ⁺	1/12 I+					
* Potentilla ambigua Camb.	I ⁺	1/12 I+					
* Marmoritis rotundifolia Benth.	I ⁺	1/12 I+					
* Allium oreoprasum Schrenk.	I ¹	1/12 I1					
Youngia tenuifolia B.et St.ssp.diversifolia B.& S.	I ⁺	1/12 I+					
* Stipa subsessiliflora Roshev.	II ⁺¹	1/12 II+-1					

Steppe and semidesert communities of the alpine belt	Aconogonon tortuosum- Nepeta glutinosa community		Community-group of Elymus canaliculatus and Potentilla bifurca		Community-group of Elymus canaliculatus and Arabis tibetica		Community of Stipa breviflora and Tanacetum fruticosum		Community-group of Krascheninnikovia ceratoides / Ptilotrichum canescens		Community-group of Potentilla bifurca / Artemisia gmelinii		Stipa glareosa- Krascheninnikovia ceratoides community		Stipa purpurea-Carex moorcroftii community		Succession stage of Artemisia welbyi	
Serial number (nr.)	1	2	3	4	5	6	7	8	9	10	11	12						
Table-nr. / Relevé-nr.	Tab.5	37	Tab.6	Tab.6	Tab.8	Tab.5	Tab.1	Tab.1	Tab.2	Tab.4	Tab.5	316						
Number of relevés	5	1	10	5	9	6	9(A)	14(B)	12	9	7	1						
Altitude in m (a.s.l.) x 10	405-426	446	431-470	450-459	455-482	434-459	455-488	460-483	444-478	410-470	472-480	425						
Cover (Ø) %	60	70	53	44	30.6	45.8	29.4	31.8	46.3	17.2	42.8	15						
pH of rhizosphere (Ø) / effective	7,1(4)	6.6	6,5(3)	7,4(3)	7,0(4)	7,5(3)	7,7(4)	7,6(8)	7,2(8)	8,0(6)	6,9(2)	-						
Number of taxa (Ø) / effective	16.8	23	15.5	9.2	6.9	10.7	10.8	7.6	15.2	7.7	11	9						
Areas in Ladakh	<u>9</u>	<u>9</u>	<u>13</u>	<u>13</u>	<u>13</u>	<u>14</u>	<u>15</u>	<u>16</u>	<u>12, 19, 20</u>	<u>18, 20</u>	<u>17, 18</u>	<u>20</u>						
Year of publication, 19..	83	83	87	87	87	90	97	97	99	99	99	99						
* <i>Saussurea glanduligera</i> Schltz.-Bip.	I ⁺	1/12 I+	
* <i>Salsola</i> sp.	I ⁺¹	.	.	.	.	.	.	.	.	1/12 I+-1	
<i>Axyris hybrida</i> L.	1/12 I+	
<i>Marrubium marrubiastrum</i> Hedge	+	1/12 I+	
<i>Astragalus strictus</i> Grah.et Benth.	II ⁺¹	.	.	.	.	.	.	.	1/12 II+-1	
<i>Polygonum polycnem.</i> J.et S./ <i>rottboell.</i> J.et Sp.	II ⁺	1/12 II+	
* <i>Torularia</i> cf. <i>humilis</i> (Mey.)O.E.Schulz	I ⁺	1/12 I+	
<i>Sibbaldia cuneata</i> Kze.var. <i>micrantha</i> RRS.	1/12 +	
<i>Geranium</i> cf. <i>regelii</i> Nevski	+	1/12 +	
* <i>Viola</i> sp.	+	1/12 +	
<i>Kobresia royleana</i> (Nees)Boeck.	+	1/12 +	
<i>Potentilla argyrophylla</i> Wall.	+	1/12 +	
<i>Astragalus</i> cf. <i>rhizanthus</i> Royle	+	1/12 +	
* <i>Crepis multicaulis</i> Led.ssp. <i>congesta</i> Babč.	+	1/12 +	
<i>Polygonum cognatum</i> Meissn.	+	1/12 +	
<i>Cicer microphyllum</i> Benth.	+	1/12 +	
<i>Leontopodium nanum</i> (Hk.f.et Th.)Hnd.-Mzt.	+	1/12 +	
<i>Elymus schrenkianus</i> (Fisch.et Mey.)Tzvel.	+	1/12 +	
<i>Trisetum spicatum</i> (L.)Richt.	+	1/12 +	
<i>Androsace septentrionalis</i> L.	+	1/12 +	
<i>Artemisia macrocephala</i> Jacq.ex Bess.	+	1/12 +	
<i>Lappula heterantha</i> (Led.)Gürke	+	1/12 +	
<i>Lonicera spinosa</i> (Decne.)Walp.	+	1/12 +	
* <i>Halogeton arachnoideus</i> Moq.	II ⁺	1/12 II+	
<i>Arnebia guttata</i> Bunge	II ⁺⁺	1/12 IIr-+	
<i>Salsola tragus</i> L.	II ⁺⁺	1/12 IIr-+	
* <i>Corispermum tibeticum</i> Jlin	I ²	.	.	.	.	.	.	1/12 I2	
<i>Nepeta floccosa</i> Benth.	I ²	.	.	.	.	.	.	1/12 I2	
<i>Erodium tibetanum</i> Edgew.	I ⁺	1/12 I+	
* <i>Stipa purpurea</i> Griseb.	IV ⁺³	.	.	.	.	.	1/12 IV+-3	
* <i>Senecio</i> sp.	I ⁺	1/12 I+	
<i>Hypocoum leptocarpum</i> Hook.f.et Th.	I ⁺	1/12 I+	
<i>Arenaria bryophylla</i> Fern.	I ⁺	1/12 Ir	
* <i>Astragalus heydei</i> Baker	I ⁺	1/12 Ir	

* species listed only in this table

7.5 *Caragana versicolor* community and highalpine *Artemisia minor* – *Potentilla pamirica* steppe (Table 5)

The high alpine steppe with *Artemisia minor* and *Potentilla pamirica* is confirmed with three relevés from the N-side of the Taglang La at an altitude of 4780 to 5200 m a.s.l. (nr. 1, Table 5). It presents a transition between desert-steppe and the loose grassland of the high alpine belt.

Compared to the desert-steppe, the aerial parts of the plants cover approximately half of the ground surface. The mean species number is enhanced by around four and important representatives of the characteristic species combination (of the desert-steppe) such as *Euphorbia tibetica*, *Christolea crassifolia*, *Scrophularia dentata* and *Oxytropis microphylla* lack altogether or are only insignificant, e.g. *Ptilotrichum*, *Krascheninnikovia* and *Stipa glareosa*. Moreover, the best represented taxa (both in relation to presence and cover-abundance) such as *Potentilla pamirica*, *Arenaria bryophylla*, *Poa attenuata* and *Saussurea nana*, do have their main distribution clearly in the high-alpine grassland belt. The same does not hold true for *Artemisia minor*, which tops the species list of the currently discussed community in relation to the cover-abundance, but which is hardly found in the neighboring grassland communities.

Also *Thylacospermum* and *Stellaria persica* do have their distribution in the highest vegetation belt, but lack e.g. in relevé Nr. 2 of Table 2 (1997) at the lowest altitude. Exactly at that site, *Artemisia gmelinii* dominates and therefore indicates ecologically – together with *Poa sterilis*, *Krascheninnikovia* and *Ptilotrichum* – more arid conditions. The contrary holds true for the in only one list stated *Leontopodium nanum*, *Tanacetum tibeticum* and *Astragalus confertus*: i.e. they prefer high alpine grassland.

To summarize, the steppe with *Artemisia minor* and *Potentilla pamirica* is not less well delimited from the alpine grassland than from the alpine desert-steppe. To the high alpine grassland belong many species, which lack in the steppes altogether. Among those with the highest presence degree are *Draba glomerata*, *Aster flaccidus* and *Kobresia schoenoides*.

The 19 relevés of the dwarf-shrub community with *Caragana versicolor* are distributed among the following regions: Matho Phu between 4410 and 4550 m a.s.l. (3), catchment area of the Kanda La 4540 – 4850 m (4), high valley of Nimaling 4800 – 4860 m (2), northern slopes of the Taglang La 4870 – 4890 m (2), Rupshu (SE of the Taglang La) with Debring 4820 – 4840 m (2), with Tso Kar 4760 m (1), with Norbo (More Plaine) 4800 – 4890 m (4) and Karzok Phu at the Tso Moriri 4750 – 4800 m a.s.l. (1). The community in which the shallow growing and completely lignified *Caragana* always predominates is very characteristic and widely distributed in central parts of the country and especially in the E of Ladakh. Where the first stands can be expected in the W is not known in detail, the own first records of *Caragana versicolor* on the journey from the W to the E originate from the area in the S of the Fotu La.

First relevés were possible in the Indus Valley at the alpine pastures of Matho Phu. The dark-green low dwarf shrub, where *Caragana* in most cases covers more than ¾ of the ground surface, contrast everywhere

clearly from the surrounding steppe. It is a species-poor and in relation to the companion species not very homogeneous community. *Potentilla bifurca* and *Artemisia gmelinii* belong to the representatives which are present in most variants of the community-group in alpine steppes. Also within the *Caragana*-community, they belong to those tribes with the highest presence degree. Added for sure to the characteristic species-group are also *Potentilla multifida* and *Elsholtzia eriostachya* var. *pumila*. Restricted to the variant of Matho Phu and the Kanda La are *Poa pratensis* ssp. *pruinosa*, *Elymus nutans* and *Elymus canaliculatus* as well as *Kobresia royleana*. Only in the relevé areas of Matho Phu, the moss *Barbula vinealis* was growing in the shadow of *Caragana* with high cover abundance.

In the region of Matho Phu and at the Kanda La, the densest stands with larger extension colonize preferably the neighborhood of brooks and more or less wide couloirs. Pronounced detritus soils, predominantly containing coarse rocks from shales, sandstone and occasionally conglomerate, form the root horizon. The detritus is well consolidated up to the surface everywhere, which makes the ground easily passable even at steep inclines.

In a detailed view, the stands in the area of Matho Phu show (in analogy to the alpine steppe) with an average of 11.7 (9 – 15) somewhat more species than those at the Kanda La with 8.5 (5 – 14) taxa per stand-area. At the Kanda La on the other hand the shallow dwarf-shrub reaches a higher altitude than at Matho Phu. Close to the passage over the pass, the highest located stands of *Caragana versicolor* at an altitude of at least 4950 m were found. In the surroundings also the 5000 m-borderline is likely to be reached. Since, besides dried dung, the wood of the dwarf-shrub is valued as combustible material in all areas at high altitudes, the *Caragana*-vegetation might have been subject to a reduction at many localities in the course of time.

At the beginning of the Markha Valley in the east, *Caragana* stands occur from around 4400 m upwards more frequently, first along brooks, further upwards also on slopes. At the far end of the main valley, *Caragana* becomes somewhat more frequent also at less steep slopes but only close to the transition into the plain of Nimaling. The proper high valley of Nimaling is characterized by a large *Caragana*-area, which exclusively covers the right slope of the valley in a S-exposition between 4750 and 4900 m a.s.l.. The on the average 20–30 cm high dwarf-shrub forms an impenetrable thicket with numerous aisles, which remain open by the continuous and intense grazing activity of sheep and goats. Presumably, the strikingly low species number of the two relevés (nr. 4, Table 5) can be deduced to the unusually strong grazing activity.

Dispersed over a larger area are the relevés of nr. 2 (Table 5) summarized from Table 3 in HARTMANN (1997). They extend from the N- side of the Taglang La to its S- side, to Debring, to the basin of the Tso Kar and to the More Plain up to Norbo, but they all lay within an altitude range of only 200 m (4760 – 4890 m). A view of Ladakh shows that the share of the *Caragana*-vegetation is increasing in E – SE direction and finally reaches its largest extension in the east and southeast of the Taglang La, in the district of Rupshu. According to ZHANG JINGWEI & al. (1982), *Caragana versicolor* is one of the most important shrubs in the semi-arid regions within the change to the Tibetan Plateau, where this species is reported to be distributed on mountain slopes. WANG JIN-TING (1988) reported *Caragana* in his study area of the Tibetan high-plateau only in the community with *Ceratoides*

latens? (= *Krascheninnikovia pungens*) and therefore in the subalpine desert. In Ladakh on the other hand, the Caragana-community is limited to the alpine belt. In the further surroundings of the Taglang La, it can hardly be expected below 4600 m a.s.l., although at lower altitudes single specimens and small gatherings of this plant can still be met at special localities e.g. along brooks. Going upwards, these continuous dwarf-shrub carpets often end only at or slightly above 5000 m. At steeper or flatter slopes with grooves, couloirs or depressions, *Caragana* is always concentrated at the lowest areas, where snow remains for a longer period (Photo Nr. 24 and 25).

Regarding the cover value, which is mainly given by the cover abundance of *Caragana* itself, differences exist between the northern region from the Taglang La to the Tso Kar and the southern section of the More Plain near Norbo. A value of 80 % (70 – 90 %) of the first 5 relevés is identical with the one of earlier relevés of 81.7 % (65 – 90 %). In the relevé list from the surroundings of Norbo only an average of 45 % (40 – 50 %) is attained. The impression of a significantly looser plant cover also remains with a view over the wide southern sections of the More Plain. At the southern edge and upon the descent towards Pang, the semi-desert character of the landscape becomes more pronounced. Further to the S and SW in the direction of the Lachalung La, a true alpine desert is reached, where *Caragana* can be found only scattered and at locally favored niches.

From a floristic point of view, there is a close relationship to the neighboring alpine desert-steppe and steppe. Besides the dominating *Caragana*, the eastern variant includes *Krascheninnikovia* with the highest presence degree. To the characteristic species-group of the eastern variant belong also *Potentilla multifida* and *Elsholtzia eriostachya* var. *pusilla*, frequently included are also *Elymus jacquemontii* and *Oxytropis tatarica*, slightly less frequent are *Saussurea nana* and *Dracocephalum heterophyllum*. Exclusively in this community or only also in alpine grassland recorded were *Pleurospermum stellatum*, *Puccinellia himalaica*, *Rheum spiciforme* and *Christolea stewartii*.

The throughout strong grazing influence – especially by sheep and goats– has already been mentioned. Maybe the fact that the wood of *Caragana* is being used by humans as firewood is less known. In all visited areas with a *Caragana*-vegetation, it could be proved in some way that although to a rather limited extend, plants of the dwarf-shrub were exhumed and exposed for drying to be subsequently used as firewood. Currently it is unknown in what kind and to which extend such a use will influence the vegetation and the landscape.

Table 5

Caragana versicolor community and highalpine Artemisia minor-Potentilla sericea steppe	Artemisia minor-Potentilla sericea community	Caragana versicolor community of the region of Taglang La / Rupshu	Caragana community of the region of Matho Phu and Kanda La	Relevés in the Caragana versicolor community of Nimaling	Relevé in the catchment area of Tso Moriri
Serial number (nr.)	1	2	3	4	5
Table-nr. / Relevé-nr.	Tab.2	Tab.3	Tab.7	206/207	338
Number of relevés	3	9	7	2	1
Altitude in m (a.s.l.) x10	478-520	476-489	441-485	480-486	475-480
Cover (Ø) %	46.7	64.4	84.3	72.5	75
pH of rhizosphere (Ø) / effective	7,7(3)	7,9(3)	7,1(2)	7.1	5.9
Number of taxa (Ø) / effective	14	11.8	9.9	7	6
Areas in Ladakh	15	15, 16	13	14	18
Year of publication, 19..	97	97	87	90	99
<i>Krascheninnikovia ceratoides</i> (L.)Gueld.	II ⁺	V ⁺²	I ⁺	2/3	+
<i>Potentilla bifurca</i> L.	IV ¹⁻²	II ¹	IV ⁺²	2/2	2
<i>Poa attenuata</i> Trin.	V ⁺²	III ¹⁻²	I ¹	1/1	.
<i>Poa sterilis</i> M.Bieb.	II ⁺	I ²	III ⁺²	.	1
<i>Caragana versicolor</i> Benth.	.	V ³⁻⁵	V ⁺⁵	4/3	4
<i>Tanacetum tibeticum</i> Hook.f.et Th.	II ¹	III ⁺¹	I ¹	.	.
<i>Rhodiola tibetica</i> (Hook.f.et Th.)Fu	II ⁺	I ⁺	III ⁺	.	.
<i>Potentilla pamarica</i> Wolf.	V ⁺²	III ⁺¹	.	+/.	.
<i>Arenaria bryophylla</i> Fern.	V ⁺²	I ¹	.	+/.	.
<i>Artemisia gmelinii</i> Weber ex Steckm.	II ³	.	III ⁺¹	/1	.
<i>Elymus jacquemontii</i> (Hook.f.)Tzvel.	IV ⁺	IV ⁺²	.	.	1
<i>Oxytropis tatarica</i> Camb.ex Bge.	IV ¹	IV ⁺¹	.	.	.
<i>Saussurea nana</i> (Pamp.)Pamp.	V ⁺¹	III ⁺¹	.	.	.
<i>Dracocephalum heterophyllum</i> Benth.	V ⁺¹	III ⁺¹	.	.	.
<i>Artemisia minor</i> Jacq.ex Bess.	V ²⁻³	II ¹⁻²	.	.	.
<i>Thylacospermum caespitosum</i> Schischk.	IV ⁺¹	I ⁺	.	.	.
<i>Festuca olgae</i> (Regel)Krivot.	II ⁺	II ⁺¹	.	.	.
<i>Kobresia capillifolia</i> (Decne.)Clarke	II ²	I ¹	.	.	.
<i>Leontopodium nanum</i> Hand.-Mazz.	II ³	I ⁺	.	.	.
<i>Stellaria cf. persica</i> Boiss.	IV ¹	.	II ⁺	.	.
<i>Potentilla multifida</i> L.	.	IV ⁺¹	III ⁺¹	.	.
<i>Elsholtzia eriostachya</i> Benth.var.pusilla Hk.f.	.	III ⁺²	I ¹	.	.
<i>Arabis tibetica</i> Hook.f.et Th.	.	II ⁺	II ⁺	.	.
<i>Elymus schrenkianus</i> Tzvel.	.	I ²	.	1/1	.
<i>Draba lanceolata</i> Royle	.	II ⁺	.	.	+
<i>Urtica hyperborea</i> Jacq.	.	.	II ⁺	/+	.
<i>Stipa breviflora</i> Griseb.	IV ¹	.	.	.	.
<i>Astragalus confertus</i> Benth.	II ¹	.	.	.	.
<i>Ptilotrichum canescens</i> (DC.)C.A.Mey.	II ⁺
<i>Stipa caucasica</i> Schm.ssp.glareosa Tzvel.	II ⁺
<i>Taraxacum</i> sp.	II ⁺
<i>Polygonum molliaeforme</i> Boiss.	.	II ¹⁻²	.	.	.
<i>Chenopodium pamaricum</i> Iljin	.	II ⁺²	.	.	.
<i>Axyris hybrida</i> L.	.	II ¹	.	.	.
<i>Androsace cf.robusta</i> Hand.-Mazz.	.	II ¹	.	.	.
<i>Chrysanthemum pyrethroides</i> Fedtsch.	.	II ⁺¹	.	.	.
<i>Pleurospermum stellat.</i> Bth.var.lindl. C.B.C.	.	II ⁺¹	.	.	.
* <i>Rheum spiciforme</i> Royle	.	II ¹⁻⁺	.	.	.
<i>Stellaria cf.montioides</i> S.A.Ghazanf.	.	I ²	.	.	.
<i>Carex moorcroftii</i> Falc.ex Boott.	.	I ¹	.	.	.
<i>Silene gonosperma</i> Bocq.ssp.himalayensis Bq.	.	I ⁺	.	.	.
<i>Puccinellia himalaica</i> Tzvel.	.	I ⁺	.	.	.
<i>Oxytropis microphylla</i> DC.	.	I ⁺	.	.	.
<i>Marrubium marrubiastrum</i> (Steph.)Hedge.	.	I ⁺	.	.	.
* <i>Christolea stewartii</i> Jafri	.	I ⁺	.	.	.
<i>Draba glomerata</i> Royle	.	I ¹	.	.	.
<i>Poa pratensis</i> L.ssp.pruinosa (Korot.)Dické.	.	.	IV ⁺¹	.	.
<i>Elymus nutans</i> Griseb.	.	.	III ¹⁻²	.	.
<i>Elymus canaliculatus</i> (Nevski)Tzvel.	.	.	III ⁺²	.	.
<i>Kobresia royleana</i> (Nees)Boeck.	.	.	III ⁺¹	.	.
<i>Eritrichium canum</i> Kitam.	.	.	III ⁺¹	.	.
<i>Lindelofia stylosa</i> (Kar.et Kir.)Brand	.	.	II ¹	.	.

Caragana versicolor community and highalpine Artemisia minor-Potentilla sericea steppe	Aartemisia minor-Potentilla sericea community	Caragana versicolor community of the region of Taglang La / Rupshu	Caragana community of the region of Matho Phu and Kanda La	Relevés in the Caragana versicolor community of Nimaling	Relevé in the catchment area of Tso Moriri	
Serial number (nr.)	1	2	3	4	5	
Table-nr. / Relevé-nr.	Tab.2	Tab.3	Tab.7	206/207	338	
Number of relevés	3	9	7	2	1	
Altitude in m (a.s.l.) x10	478-520	476-489	441-485	480-486	475-480	
Cover (Ø) %	46.7	64.4	84.3	72.5	75	
pH of rhizosphere (Ø) / effective	7,7(3)	7,9(3)	7,1(2)	7.1	5.9	
Number of taxa (Ø) / effective	14	11.8	9.9	7	6	
Areas in Ladakh	15	15, 16	13	14	18	
Year of publication, 19..	97	97	87	90	99	
<i>Lonicera spinosa</i> (Decne.)Walp.	.	.	I ¹	.	.	1/5 I1
<i>Silene moorcroftiana</i> Wall.	.	.	I ¹	.	.	1/5 I1
<i>Piptatherum gracile</i> Mez	.	.	I ¹	.	.	1/5 I1
<i>Koeleria cristata</i> (L.)Pers.	.	.	I ¹	.	.	1/5 I1
<i>Geranium cf.regelii</i> Nevski	.	.	I ¹	.	.	1/5 I1
<i>Festuca alaica</i> Drob.	.	.	I ⁺	.	.	1/5 I+
<i>Thesium hookeri</i> Hedrych	.	.	I ⁺	.	.	1/5 I+
<i>Artemisia stricta</i> Edgew.	.	.	I ⁺	.	.	1/5 I+
<i>Chenopodium cf.karoi</i> (Murr)Aellen	.	.	I ⁺	.	.	1/5 I+
<i>Aconogonon tortuosum</i> (D.Don)Hara	.	.	I ⁺	.	.	1/5 I+
<i>Carex pseudofoetida</i> Kük.	.	.	I ⁺	.	.	1/5 I+
* <i>Silene vulgaris</i> (Moench)Garcke s.l.	.	.	I ⁺	.	.	1/5 I+

* species listed only in this table

7.6 Grassland communities of the alpine and highalpine belt (Table 6)

From the very flat and wide passage over the Pensi La originate the most western investigated grassland communities from the lower alpine belt (nr. 1 and 2, Table 6). The high plains of the Pensi La link the flat basin of Rangdum in the eastern Suru Valley with the valley of the Doda River in Zaskar. The relevé sites for nr. 1 (Table 6) lie within a relatively narrow area of only a few square kilometers. Since the community with dominating *Kobresia schoenoides* is limited to flat or slightly inclined slopes, all investigated stands lie within the same altitude range of only 100 m between 4300 and 4400 m a.s.l. Five lakes of varying size and several moraine-walls enrich this landscape.

Wherever the plant cover was not subject to an external disturbance, the grassland appears strikingly homogeneous. Nevertheless, nowhere a complete cover is attained. On the average a cover value of about 80% results. On an area of 100 m² on the average 15 (15.3) species were recorded. The uniformity of the loose grassland is due mainly to the high dominance of the *Kobresia schoenoides*-tufts.

The characteristic species combination of the *Kobresia*-grassland at the Pensi La includes (besides *Kobresia schoenoides*) *Saxifraga flagellaris*, *Rhodiola wallichiana*, *Cerastium cerastioides*, *Trisetum spicatum*, *Poa sterilis*, *Leontopodium leontopodium* and *Saussurea falconeri* (s. Tab. 3 in 1990). Only in this community found were *Primula minutissima* and *Trachydium roylei*. Based on the groups of differential species two variants of the community can be differentiated: *Thalictrum alpinum*, *Primula minutissima* and *Sibbaldia cuneata* (I) and on the other side (II) with *Psychrogeton andryaloides* var. *denudatus*. They do not completely overlap in regard to their ecological needs. Variant I colonizes the somewhat moister niches which is reflected by the three differential species all renowned as moisture indicators. Accordingly, the cover value also is with an average of 82.5 % (75 – 95 %) slightly higher than in variant II with 75.8 % (65 – 85 %).

Gravel, detritus of moraines and coarse rock debris of different gneisses or a relativ thick layer of alluvial sand and silt form the C-horizon of the often brown-soil like ground. The soil moisture is influenced on the one hand by the exposition, linked to the duration of the snow cover, but on the other hand it is affected by the soil itself i.e. by the content of silt- and clay fractions. Generally the subsoil and the topsoil at the relevé sites of variant II are more shallow, often more stony.

Even if at the Pensi La during the last week of August with the exception of marmots no grazing animals could be seen, based on footprints and dung it can be assumed that these turfs are temporarily exposed to an intense grazing by flocks of animals. Since ancient times an important route for horse- and donkey caravans led over the Pensi La between Kishtwar / Zanskar and Kargil. In recent times trekking groups, who find ideal camping conditions in the flat terrain of the pass, have contributed to the intensification of the traffic.

Wherever at the Pensi La the terrain at the southern and northern edge surpasses an incline of around 15°, the detritus slopes are colonized by other communities especially by the one with *Nepeta discolor* and / or *Festuca kashmiriana* (nr. 2, Table 6). Floristically this community can be easily distinguished from the *Kobresia*-turf. *Kobresia schoenoides* does not lack altogether, but it is present isolated and with often reduced vitality. Differential species which occur in 60% of the relevés of Table 4 (1990) and which are almost or completely lacking in the *Kobresia* – community are the following: *Nepeta discolor*, *Festuca kashmiriana*, *Geranium himalayense*, *Piptatherum laterale*, *Artemisia* cf. *brevifolia*, *Bistorta affinis* and *Elymus canaliculatus*. More rarely, but found only in this community were *Calamagrostis pulchella* and *Elymus dentatus*. Exclusively recorded in the two communities of the Pensi La were *Psychrogeton andryaloides* var. *denudatus* and *Draba setosa*.

Within the eight stands, based on two groups of differential species – *Oxytropis cachemiriana* and *Lindelofia stylosa* – here also two variants (A and B) can be distinguished. Their differences are most likely caused by different soil conditions. Variant B with 23 taxa per 100 m² has significantly more species compared to A with an average of 15 species per stand. Similarly, the mean cover in B with 77.5 % is clearly higher than in A with 62.5 %.

In relation to the soil conditions the two variants differ as much as the topsoil of the relevé sites in variant B is characterized by a remarkable content of dark- to blackish-brown fine soil. Below the vegetation cover of the community with *Nepeta discolor* and / or *Festuca kashmiriana* in general different transition stages between a Ranker and a weakly developed alpine turf brown-soil can be found. The soil in variant B is rather a transition stage to a turf brown-soil, whereas the soil of variant A can be viewed as a Ranker.

The fine soil of the top horizon with a more or less pronounced content of humus is generally interspersed with stones up to the surface. Therefore, the soil surface leaves a remarkably stony impression. At least $\frac{1}{3}$ of the area is in each case covered by larger rocks. More rarely coarse rock debris lie more or less loose on the surface.

At the higher altitude of the alpine and at the high alpine belt of central Ladakh but also further to the SE in the direction of Rupshu and within the Ladhak Range, the turf-communities with *Poa attenuata* and *Potentilla pamirica* (nr. 3 – 6, Table 6) form the most important part of the plant cover. Where and in which form the community-group occurs further to the W is at the moment not entirely clear. At the S and SE of Rupshu at the Tso Moriri and in the E towards the Pangong Tso, this loose grassland is gradually replaced by alpine steppe and finally by the alpine desert.

The 33 relevés from the high-alpine belt summarized in Tables are distributed over a wide area. Especially noteworthy is therefore the high uniformity of the characteristic species-group. In all areas and tables recorded are: *Poa attenuata*, *Potentilla pamirica*, *Leontopodium nanum*, *Aster flaccidus*, *Astragalus confertus*, *Stellaria* cf. *persica* and *Draba altaica*. Further to be added would be *Oxytropis humifusa*, which lacks only in the stands of the Taglang La region.

Nineteen relevés are summarized in nr. 5 and 6 of Table 6 which have been recorded in the following regions: Matho Phu and Stok Phu (side valleys of the Indus), Kanda La at the transition into the Markha Valley and the high valley of Nimaling as the most eastern section of the Markha Valley. On Matho Phu, Stok Phu and at the Kanda La more or less continuous grasslands (but often only as fragments) were found at the highest altitude of approximately 5000 m a.s.l. In the high valley of Nimaling larger, albeit interrupted, patches of grassland reach at slightly inclined slopes even about 5200 m a.s.l. (5170 m). On the average the relevé-areas of Table 7 (1990) lay at almost 4900 m a.s.l. (4889 m), the most extreme sites in a vertical direction are within an altitude range of 500 m (4680 – 5170 m). The average incline is 15° and varies from 0 to 25°. In the standard areas the mean cover degree reaches 75 % (74.7 %) with a range from 40 to 95 %. Per relevé area on the average 17 (17.4) different species were listed (9 – 24).

Within the community-group of Table 7 (1990), based on the corresponding groups of differential species, four variants or communities can be distinguished: with the species-group I of *Dasiphora dryadanthoides*, *Nepeta discolor* and four further representatives the high alpine grassland recorded in the region of Matho Phu (Ia) is considered. In the surroundings of Matho Phu such grassland forms in the vertical direction the continuation

of the alpine steppe, in this case of the community with *Acantholimon lycopodioides*. This change in the vegetation takes place only above around 4700 – 4800 m a.s.l. The grassland variant does not form a continuous belt. Obviously, with smaller and larger patches it colonizes preferably the somewhat moister sites. Next to them and further above, it disintegrates into gravel-fields. The altitude range, within which this grassland is formed, hardly attains 200 m. At the investigated localities of Matho Phu above 5000 m only isolated vascular plants grow. From an economical point of view the extended alpine steppe with *Acantholimon* is without doubt much more important as exploitable pasture compared to the high alpine grassland with *Dasiphora dryadanthoides* and *Nepeta discolor*, since the latter covers a very limited area.

With the second characteristic species group, which includes besides the naming *Draba oreades* and / or *Gentiana leucomelaena* five further species, variant Ib (Table 7, 1990) can be distinguished. Concerning the species number the community Ib with an average of 18 (13 – 21) species is equivalent to Ia with 19 species (13 – 23). But concerning the cover value, Ib with 87.5 % is very distinct of the grassland at Matho Phu (Ia) with just 53.3 %. The denser plant cover, along with a soil with a higher humus content, can most likely be explained by a locally more favorable water supply. This assumption is affirmed by the fact that in each of these sampling plots at least four to seven noteworthy mosses were found (1990, p. 546).

In the case of the highland at Matho Phu it was already stated that the grassland exists mainly in limited smaller and larger patches. This impression becomes even more pronounced for the regions situated further to the west. From Stok Phu over the Stok La up to the Kanda La (s. also Ic of Table 7, 1990) continuous grassland can only be found at isolated sites, it is mostly patchy and on a soil which is influenced in some form by water. Therefore, it is hardly justified to speak of a continuous grassland belt in this area. Basically, a rather rare exudation of water along some sort of spring-horizons facilitates the formation of local islets of grassland everywhere (s. Abb. 6, 1990). Frequent hummock-like formations even without visible influence of water can probably be attributed to interactions caused by freezing, which are hardly possible without the presence of soil water.

To a higher category (order ? class ?) with *Poa attenuata* and *Potentilla pamirica* belong also the 10 relevés of community II, (Table 7, 1990) with *Festuca tibetica* and / or *Arenaria bryophylla* from the high valley of Nimaling. Besides *Festuca* and *Arenaria* six further species belong to the differential-group, which lacks in the other communities mentioned so far (Ia – Ic), s. Table 7 (1990). By the characteristic species group 3 and 4 in Table 7 (1990), floristically two variants or communities are distinguished: community IIa with *Kobresia schoenoides* and *Trisetum spicatum* ssp. *himalaicum* and IIb without real differential or characteristic species. As a potential differential species only *Potentilla bifurca* can be mentioned, which is lacking in IIa altogether, but which is listed in three out of five relevés of the community IIb and there with a notable frequency.

In the high valley of Nimaling, the community IIa colonizes the left, southern side of the valley predominantly at sites with a northern or eastern exposition, to a limited extend also at terrace-like flat areas. With the mean cover value of 85 % (75 – 95 %) the vegetation cover is significantly denser as compared to community IIb

with 63 % (50 – 80 %). The latter one was found in this region only on the right side of the valley and at a SW exposition, locally also in the valley-bottom. The mean species number is in IIa with 21.2 (17 – 24) strikingly higher than in IIb with 15 (11 – 19) taxa. On sites exposed to the SW, the loose grassland surpasses the 5000 m-line only slightly. Above around 4900 m it takes over from the *Caragana* – dwarf-shrub and covers upwards the flat section in a monotonous way. Last islet-like patches were recorded at the right, northern side of the valley at around 5100 m a.s.l.

On the left side of the valley the vegetation summarized by community IIa is present at least 100 m further upwards. Larger continuous, but only loose, turf areas do not completely attain (according to own findings) the altitude of 5200 m a.s.l. Unexpectedly high is the species number at this altitude, as on an area of approximately 80 – 100 m² almost 20 different flowering plants were observed. In contrast to the right side of the valley, the slopes on the left side are already at the lower end covered with grassland of *Kobresia royleana* and *Trisetum spicatum*. Such turf in the community IIa coincides with a moister habitat. This follows from the fact that all differential species of group 3 with *Thalictrum alpinum*, *Aphragmus* etc. as well as *Kobresia royleana* are real indicators of fresh to moist soil conditions. To the same ecological setting fits the presence of mosses, as in four out of five relevés mosses were registered, in relevé number 8 (Table 7, 1990) even with a cover value of almost 20 %. In the sample plots of community IIb mosses lack altogether.

For the community on the left side of the valley (IIa), a mostly shallow, more seldom a middle-deep topsoil with differing content of stones and humus characterizes the ranker-like ground. In the stands at the highest altitudes of 5170 m a.s.l. the substrate has rather the nature of a compact raw soil. The top soils at the right side of the valley are raw soils in the true sense, extremely poor in humus and which are characterized by changing content of silt, sand and stones, often also with fine or coarse debris.

In the surroundings of the Taglang La and most likely a bit further to the E, SE and S, the never densely closed high alpine turf communities with *Poa attenuata* and *Potentilla pamirica* form the uppermost vegetation belt and therefore also the upper border-line of a more or less continuous grassland. In earlier reports it was shown that the altitude levels in Ladakh ascend most notably in the W-E direction (s. e. g. 1987 and 1990). This ascent exists even more clearly in the far eastern parts of the country. Accordingly, the 5000 m contour-line is barely reached by more or less continuous grassland at Matho Phu, Stok Phu and at the Kanda La. But further to the SE, in the high valley at Nimaling, loose grassland areas are present at almost 5200 m a.s.l.. And still a little bit further to the SE, in the surroundings of the Taglang La, the corresponding turf community finally reaches an altitude of 5300 m. Here the high alpine community with the characteristic species combination can be found from 4900 up to 5300 m a.s.l.

For a detailed explanation of the last two relevés in Table 4 (1997) see HARTMANN (1997 p. 155). The remarkable average altitude of 5169 m a.s.l. (4950 – 5300 m) for the eight relevés of variante A coincides with an unexpectedly high species number of almost 19 (18.6) per 100 m² with a variation between 15 and 24 taxa. With an average cover degree of 72 % (60 – 80 %) the aerial parts of the plants cover nearly ¾ of the ground surface. Therefore, this vegetation may be called a “loose or interrupted grassland”.

The five representatives of the first species group in Table 4 (1997) characterize the eastern variant of the high alpine turf. Looking from the NW direction, this community occurs for the first time in the high valley of Nimaling, where *Thylacospermum*, *Saussurea nana*, *Arenaria bryophylla* and *Festuca tibetica* strike as “newcomers”. Solely *Thylacospermum* has already been once included in a list from the region of Matho Phu. On the other hand the highly steady *Draba glomerata* has not been found further to the W and to the N of the Taglang La.

First complete species lists of the high alpine belt in the Ladakh Range are given by the four relevés from the region of the two high passes Khardung La and Chang La (nr. 4, Table 6). In comparison to the alpine steppe with *Potentilla bifurca* and *Artemisia gmelinii* the plant cover is significantly higher and with 66.3 % (50 – 75 %) the aerial parts of the plants cover at least $\frac{2}{3}$ of the ground surface. Nr. 1 in Tab. 3 (1999) presents as a single relevé the high-alpine belt at the Chang La on the northern side at 5150 m a.s.l. The three other relevés of this Table illustrate the grassland-vegetation on the south side of the Khardung La between 4700 and 5100 m a.s.l. The lowest stand, Nr. 4 (1999), is hardly a characteristic example of this community, although of the eight listed taxa of the characteristic group, seven are present. On the other hand, it is the stand with remarkably numerous unique species, of which more than half also occur in the alpine steppe. The remarkably high number of 29 species is probably the consequence of “micro-habitats” within the investigated area, which may be due to granite rocks in the soil which tower above the surface significantly.

As in the investigated eastern parts of the country to the S of the River Indus, the community with *Poa attenuata* and *Potentilla pamirica* can be described among the zonal communities also for the Ladhak Range as the plant cover with the highest species diversity. With at least 20 taxa (21.5) on the average per relevé-area, there is a good conformity with the comparable vegetation at the Taglang La (19).

At present, it is not known in which form the community extends towards the E and SE in the direction of Tibet. It is to be assumed that given the increasing aridity in this direction, it turns into a steppe or desert-steppe and in the extreme case in a cold desert in the true sense as described by WANG JIN-TING (1988) as “High-cold steppe” and “High-cold desert”.

In the high altitudes of the two passes, the landscape is imprinted besides solid rocks by coarse rock debris. Larger continuous areas of the loose grassland therefore are rather an exception. More often the plant cover is distributed in small islets between the rocks and between areas of coarse rock debris. For this reason, the same vegetation can be exposed to grazing in a significantly varying intensity. Wherever the admission is not too much hindered by rocks and areas of coarse rock debris, domestic animals, such as yaks, dzos, donkeys and others graze. Otherwise only marmots and wild sheep can be expected.

Among the for the order characteristic 2. species group with *Poa attenuata*, *Potentilla pamirica* and five further characteristic species (s. Table 4, 1997), at least four, in most cases five to six species are present. An equal number of characteristic species is found in the single relevés of nr. 8 and 9 in Table 6. Nevertheless,

these fit into none of the other Tables. The relevé of nr. 8 from an altitude of 5200 m a.s.l., at least 2 km to the north of the Taglang La, shows an almost completely closed grassland (cover value 95 %), which contains on an area of 100 m² not less than 27 different flowering plants! In comparison to the surrounding form of loose and interrupted grassland, this type of denser *Kobresia*-stands is obviously dependent on water-bearing spots in the ground. Approximately half of the taxa can be called “indicator species” for moist soils. Among these, *Kobresia schoenoides* and *Kobresia royleana* are at the top in relation to the cover abundance.

Also the stand of nr. 9 (Table 6) from the valley of Debring on the S-side of the Taglang La reflects the picture of a completely closed grassland (cover degree 100 %), as it is not too rare in the NW-part of the valley. Adjacent to a brook at 4830 m, in 50 m² 23 different taxa were recorded, among them six characteristic species of the *Poa attenuata* - *Potentilla pamirica* -community. Nevertheless, addition to one of the existing Tables is not justified based on a too high number of differing taxa. Similarly, no closer agreement in the species combination with the list of nr. 8 is given, as not more than nine common tribes could be found. The densely closed grassland areas are naturally considerably rich pastures. The region of Debring is for a certain time a favorite dwelling of nomads. There is water and the combustible material – dried dung of domestic animals – can be replenished with the wood of *Caragana*.

No floristic relationship to the community with *Poa attenuata* and *Potentilla pamirica* is found in the grassland stand of nr. 7 (Table 6) to the north of the Taglang La. In the densely closed grassland (cover value 100 %) in a rather flat area on around 4500 m a.s.l., per area (50 m²) not more than 12 species could be found, therefore only half as much as in the previously described stand (nr. 9). The partly coarse stuffed nature could be due to changing processes between freeze and thaw and further exaggerated by strong grazing activity. Whether such cushion-like structured wet grassland is related to the “Buckelweiden” of the Muktinath-Valley in Nepal as described by M. KRIECHBAUM (2002) remains at present questionable. Besides the rather different species composition, the here described “Buckelrasen” is situated at least 700 m higher. At the time of the main snow melting, the vegetation along the brook is slightly inundated. Short inundations at such spots can also be expected repeatedly during the vegetation period. The here growing moisture preferring taxa naturally lack in the surrounding desert-steppe completely.

Table 6

Grassland communities of the alpine and highalpine belt	Community dominated by <i>Kobresia schoenoides</i>	Community of <i>Nepeta discolor</i> / <i>Festuca kashmiriana</i>	<i>Poa attenuata</i> - <i>Potentilla sericea</i> community-group				Moist grassland at a plain	Higher <i>Kobresia</i> grassland	Carex grassland of Debring (Rupshu)	Incomplete species lists in grassland of the alpine belt		
Serial number (nr.)	1	2	3	4	5	6	7	8	9	10	11	12
Table-nr. / Relevé-nr.	Tab.3	Tab.4	Tab.4	Tab.3	Tab.7	Tab.7	245	239	268	Rup-shu	W Karzok	
Number of relevés	12	8	10	4	I/9	II/10	1	1	1		Tso Moriri	
Altitude in m (a.s.l.) x 10	433-438	433-446	487-530	470-515	468-493	475-517	450	520	483	480	456	456
Cover (Ø) %	79.2	66.2	67.5	66.3	75.6	74.0	100	95	100	-	-	-
pH of rhizosphere (Ø) / effective	4,6(13)	5,8(8)	6,7(4)	5,7(3)	6,5(7)	6,8(8)	8.0	-	-	-	-	-
Number of taxa (Ø) / effective	15.3	16.9	17.6	21.5	16.7	18.1	12	27	23	12	20	24
Areas in Ladakh	<u>5</u>	<u>5</u>	<u>15, 16</u>	<u>12, 20</u>	<u>13, 14</u>	<u>14</u>	<u>15</u>	<u>15</u>	<u>16</u>	<u>16</u>	<u>18</u>	<u>18</u>
Year of publication, 19..	90	90	97	99	90	90	97	97	97	97	99	99
<i>Kobresia schoenoides</i> (C.A.Mey.)Steud.	V ²⁻⁵	II ⁺	V ⁻³	III ⁻¹	II ⁻³	III ⁻³	.	3	1	x	.	.
<i>Aster flaccidus</i> Bge.ssp. <i>flaccidus</i> Griens.	II ⁺¹	.	IV ⁺²	III ⁻¹	IV ⁻¹	III ⁻²	.	1	2	.	.	.
<i>Potentilla sericea</i> L.(inkl. <i>P.aphanes</i> Soják)	.	I ⁺	IV ⁻⁴	IV ⁻³	V ⁻⁴	V ⁻⁴	.	2	+	x	.	.
<i>Trisetum spicatum</i> (L.)Richt.ssp. <i>himalaicum</i>	V ⁺²	I ⁺	I ⁺	IV ⁻²	I ⁺	II ⁻¹	.	.	.	.	.	.
* <i>Aphragmus oxycarpus</i> (Hook.f.et Th.)Jafri	+	.	+	II ⁺	II ⁻¹	II ⁻¹	.	+	.	.	.	.
* <i>Draba altaica</i> Bunge	+	.	II ⁺	V ⁻²	V ⁻²	III ⁻¹	.	.	+	.	.	.
<i>Silene gonosperma</i> (Rupr.)Bocq.ssp. <i>himal.</i>	.	I ⁺	II ⁻¹	II ⁺	II ⁻¹	II ⁻¹	.	+	.	.	.	.
<i>Astragalus confertus</i> Benth.	.	.	III ⁻²	II ²	III ⁻³	II ⁻³	.	+	1	.	x	.
<i>Bistorta vivipara</i> (L.)S.F.Gray	.	.	+	.	II ⁻²	I ⁺²	+	2	2	x	x	.
<i>Polygonum cognatum</i> Meissn.	+	III ⁻¹	+	II ⁺	I ⁺
<i>Oxytropis humifusa</i> Kar.et Kir.	+	III ⁻²	.	III ⁺	V ⁻³	V ⁻²	.	.	.	.	.	.
<i>Carex pseudofoetida</i> Kük.	II ⁺¹	I ⁺	.	II ⁺	V ⁻⁴	IV ⁻²	.	.	.	.	.	.
<i>Carex moorcroftii</i> Falc.ex Bt./ <i>melanan</i> . C.A.M.	I ⁺	I ²	I ⁻²	III ⁻¹	.	.	.	+	.	.	.	.
* <i>Thalictrum alpinum</i> L.var. <i>microphyllum</i> Hd.-Mz.	III ⁺²	.	II ⁻¹	.	III ⁻²	I ⁺²	.	+	.	.	x	.
<i>Leontopodium nanum</i> Hand.-Mzt.	.	.	V ⁻³	V ⁻³	IV ⁻²	V ⁻²	.	1	.	.	x	.
<i>Poa attenuata</i> Trin.	.	.	V ⁻³	V ⁻³	IV ⁻²	V ⁻²	.	.	1	x	.	.
<i>Potentilla bifurca</i> L.	.	.	+	II ³	III ⁻¹	II ⁻³	.	.	2	.	.	x
<i>Kobresia royleana</i> (Nees)Boeck.	.	.	+	III ⁻¹	.	III ⁻³	.	3	2	.	x	x
* <i>Potentilla gelida</i> C.A.Mey.	II ⁺²	II ⁺	.	IV ⁺	II ⁻¹	.	.	.	.	.	.	.
* <i>Waldheimia tridactylites</i> Kar.et Kir.	II ⁺	.	+	III ⁻¹	III ⁻²	.	.	.	.	.	.	.
* <i>Saxifraga flagellaris</i> Wld.ssp. <i>crassiflagellata</i>	V ⁺²	.	I ⁺	III ⁻¹	III ⁻²	.	.	.	.	.	.	.
<i>Poa sterilis</i> M.Bieb.	V ⁺³	V ⁻³	I ⁺¹	.	.	I ⁺
<i>Dasiphora dryadanthoides</i> Juzep.	.	I ⁺	+	II ²	II ⁻²	.	.	.	.	.	.	.
<i>Arabis tibetica</i> Hook.f.et Th.	.	I ⁺	+	II ²	I ⁺
<i>Stellaria cf. persica</i> Boiss.	.	.	II ⁻¹	III ⁺⁴	III ⁻¹	.	.	2	.	.	.	.
<i>Oxytropis tatarica</i> Camb.ex Bge.	.	.	V ⁻²	II ⁺	.	+	.	1	.	x	.	.
* <i>Saussurea gnaphalodes</i> Sch.-Bip.	.	.	III ⁻¹	II ⁺	II ⁻²	.	.	+	.	.	.	.
* <i>Carex sagaensis</i> Y.C.Yang	.	.	II ⁻²	.	.	.	3	2	3	.	x	.
* <i>Ranunculus pulchellus</i> C.A.M.var. <i>stracheyanus</i>	.	.	.	.	II ⁺	+	2	.	+	.	.	.
<i>Festuca olgae</i> (Regel)Krivot.	II ⁺⁴	III ²⁻³	I ⁺³	.	.	.	.	.	.	.	.	.
* <i>Rhodiola wallichiana</i> (Hook.)S.H.Fu	V ⁺²	IV ⁻²	.	IV ⁻²	.	.	.	.	.	.	.	.
<i>Cerastium cerastioides</i> (L.)Britt.	V ⁺²	II ⁺	.	III ⁺
<i>Leontopodium leontopodium</i> (DC.)Had.-Mzt.	V ⁺²	I ²	.	II ⁺	x	.	.
<i>Saussurea falconeri</i> Hook.f.	IV ⁺¹	III ⁻¹	.	II ⁺
<i>Potentilla argyrophylla</i> Wall.var. <i>leucochroa</i> Hk.f.	IV ⁻²	III ⁻²	.	II ⁺
<i>Elymus canaliculatus</i> (Nevski)Tzvel.	+	IV ⁻²	.	.	II ¹	.	.	.	.	.	.	.
<i>Sibbaldia cuneata</i> Kze./var. <i>micrantha</i> R.R.S.	III ⁺²	.	.	II ¹ x	.	III ⁻¹	.	.	.	.	.	.
<i>Potentilla multifida</i> L.	+	.	IV ¹⁻³	.	.	.	.	.	2	.	x	x
<i>Nepeta discolor</i> Royle ex Benth.	.	V ⁻³	.	III ¹	II ⁻¹	.	.	.	.	.	.	.
<i>Delphinium brunonianum</i> Royle	.	II ⁺	II ⁺	.	.	+
<i>Thylacospermum caespitosum</i> (Camb.)Schisch.	.	.	V ⁻¹	.	I ⁺	III ⁻¹	.	.	.	x	.	.
<i>Arenaria bryophylla</i> Fern.	.	.	IV ⁺¹	II ⁺	.	III ⁻²	.	.	.	.	.	.
<i>Tanacetum tibeticum</i> Hook.f.et Th.	.	.	III ⁺¹	.	II ⁻¹	I ⁺
* <i>Ranunculus lobatus</i> Jacq.ex Camb.	.	.	I ⁺	.	III ⁻¹	II ⁻¹	.	.	.	.	.	.
<i>Saussurea nana</i> (Pamp.)Pamp.	.	.	IV ¹⁻²	.	.	IV ⁻¹	.	1	.	x	.	.
<i>Elymus jacquemontii</i> (Hook.f.)Tzvel.	.	.	II ⁻²	.	.	II ⁻¹	.	.	1	.	.	.
<i>Urtica hyperborea</i> Jacq.	.	.	.	II ⁺	I ⁺	I ⁺
<i>Androsace septentrionalis</i> L.	.	.	.	II ⁺	II ⁺	+
<i>Taraxacum</i> sp.	.	.	.	.	II ⁺	+	.	+	.	.	.	x
<i>Stellaria cf. montioides</i> Ghaz.	.	.	.	.	III ⁻¹	III ⁻²	.	.	1	.	.	.
* <i>Gentiana pseudoaquadatica</i> Kusnez.	.	.	.	.	.	III ⁺	.	1	2	.	.	.
<i>Oxytropis cachemiriana</i> Camb.	III ⁻²	IV ⁺²	.	.	.	.	.	.	.	.	.	.
* <i>Psychrogeton andryaloides</i> Nov.var. <i>denudatus</i>	III ⁺¹	V ⁻²	.	.	.	.	.	.	.	.	.	.
* <i>Draba setosa</i> Royle	II ⁺¹	II ⁻¹	.	.	.	.	.	.	.	.	.	.
<i>Rosularia alpestris</i> (Kar.et Kir.)Boriss.	II ⁺¹	III ⁻¹	.	.	.	.	.	.	.	.	.	.
<i>Potentilla desertorum</i> Bunge	I ⁺	II ⁺
<i>Lindelia stylosa</i> (Kar.et Kir.)Brand	+	II ⁺

Grassland communities of the alpine and highalpine belt	Community dominated by <i>Kobresia schoenoides</i>	Community of <i>Nepeta discolor</i> / <i>Festuca kashmiriana</i>	<i>Poa attenuata</i> - <i>Potentilla sericea</i> community-group				Moist grassland at a plain	Higher <i>Kobresia</i> grassland	Carex grassland of Debring (Rupshu)	Incomplete species lists in grassland of the alpine belt		
Serial number (nr.)	1	2	3	4	5	6	7	8	9	10	11	12
Table-nr. / Relevé-nr.	Tab.3	Tab.4	Tab.4	Tab.3	Tab.7	Tab.7	245	239	268	Rup-shu	W Karzok	
Number of relevés	12	8	10	4	I/9	II/10	1	1	1	480	Tso Moriri	
Altitude in m (a.s.l.) x 10	433-438	433-446	487-530	470-515	468-493	475-517	450	520	483	456	456	456
Cover (Ø) %	79.2	66.2	67.5	66.3	75.6	74.0	100	95	100	-	-	-
pH of rhizosphere (Ø) / effective	4,6(13)	5,8(8)	6,7(4)	5,7(3)	6,5(7)	6,8(8)	8.0	-	-	-	-	-
Number of taxa (Ø) / effective	15.3	16.9	17.6	21.5	16.7	18.1	12	27	23	12	20	24
Areas in Ladakh	<u>5</u>	<u>5</u>	<u>15, 16</u>	<u>12, 20</u>	<u>13, 14</u>	<u>14</u>	<u>15</u>	<u>15</u>	<u>16</u>	<u>16</u>	<u>18</u>	<u>18</u>
Year of publication, 19..	90	90	97	99	90	90	97	97	97	97	99	99
<i>Myosotis asiatica</i> Schischk.et Serg.	+	I*	.	.	.	.	.	.	.	.	.	2/9 +I+
<i>Festuca kashmiriana</i> Stapf	+	IV ⁺³	.	.	.	.	.	.	.	.	.	2/9 +-IV1-3
<i>Bistorta affinis</i> (D.Don)Greene	+	IV ⁺¹	.	.	.	.	.	.	.	.	.	2/9 +-IV+-1
<i>Tanacetum senecionis</i> (Jacq.ex Bess.)DC.	+	II ¹	.	.	.	.	.	.	.	.	.	2/9 +-II1
<i>Gentiana tianshanica</i> Rupr.	+	I*	.	.	.	.	.	.	.	.	.	2/9 +-I+
<i>Festuca alaica</i> Drob.	III ⁺¹	.	.	II*	.	.	.	.	.	.	.	2/9 II-III+-1
* <i>Kobresia karakorumensis</i> Dickoré	+	.	.	.	II ¹⁻²	.	.	.	.	.	.	2/9 +-II1-2
<i>Kobresia capillifolia</i> (Decne.)Clarke	+	.	.	.	II ¹⁻²	.	.	.	.	.	.	2/9 +-II1-2
<i>Lomatogonium carinthiacum</i> (Wulf.)Reichb.	II ⁺²	.	.	.	.	.	.	.	1	.	x	2/9 II+-2,1,11,12
<i>Cystopteris dickieana</i> R.Sim.	.	I*	.	II*	.	.	.	.	.	.	.	2/9 I-IIr+
<i>Ephedra gerardiana</i> Wall.	.	II ¹⁻³	.	.	I*	.	.	.	.	.	.	2/9 I-IIr-3
<i>Draba glomerata</i> Royle	.	.	IV ⁺²	II*	.	.	.	.	.	.	.	2/9 II-IV+-2
<i>Artemisia minor</i> Jacq.ex Bess.	.	.	+	II*	.	.	.	.	.	.	.	2/9 +-II+
* <i>Draba oreades</i> Schrenk	.	.	I*	.	II ²	.	.	.	.	.	.	2/9 I-II+-2
<i>Draba lanceolata</i> Royle	.	.	+	.	II ⁺¹	.	.	.	.	.	.	2/9 +-II+-1
* <i>Sibbaldia tetrandra</i> Bunge	.	.	+	.	II ⁺¹	.	.	.	.	x	.	2/9 +-II+-1,10
* <i>Festuca tibetica</i> (Stapf)Alex.	.	.	I*	.	.	IV ⁺²	.	.	.	.	.	2/9 I-IV+-2
<i>Rhodiola tibetica</i> (Hook.f.et Th.)Fu	.	.	II ⁺²	.	.	.	.	+	.	x	.	2/9 II+-2,+,10
* <i>Carex borii</i> Nelmes fo. <i>lutea</i> R.R.S.	.	.	I ¹⁻⁴	.	.	.	.	2	.	.	.	2/9 II-4,2
* <i>Potentilla</i> sp.	.	.	I ¹⁻²	.	.	.	.	1	.	.	.	2/9 II-2,1
* <i>Gentiana algida</i> Pall.var. <i>nubigena</i> (Edg.)Kusn.	.	.	+	.	.	.	.	+	.	.	.	2/9 +,+
* <i>Gentiana thomsonii</i> Clarke	.	.	+	.	.	.	.	.	1	.	.	2/9 +,1
* <i>Potentilla nivea</i> L.var. <i>himalaica</i> Kitam.	.	.	.	II*	II*	.	.	.	.	.	.	2/9 II+
* <i>Saussurea stoliczkae</i> C.B.Clarke	.	.	.	II*	II*	.	.	.	.	.	.	2/9 II+
<i>Elymus schrenkianus</i> (Fisch.et M.)Tzvel.	.	.	.	II*	.	II*	.	.	.	.	.	2/9 II+
* <i>Nepeta longibracteata</i> Benth.	.	.	.	III*	.	+	.	.	.	.	.	2/9 +-III+
<i>Artemisia gmelinii</i> Web.ex Steckm.	.	.	.	II*	.	+	.	.	.	.	.	2/9 +-II+
* <i>Cremanthodium ellisii</i> (Hook.f.)Kitam.	.	.	.	II*	.	.	.	1	.	.	.	2/9 II+,1
* <i>Saxifraga hirculoides</i> Decne.	.	.	.	II*	.	.	.	+	.	.	.	2/9 II+,+
* <i>Lloydia serotina</i> (L.)Rchb.	.	.	.	.	II*	II ⁺¹	.	.	.	.	.	2/9 II+-1
* <i>Cerastium pusillum</i> Ser.	.	.	.	.	II ⁺¹	II ⁺¹	.	.	.	.	.	2/9 II+-1
<i>Gentiana leucomelaena</i> Maxim.	.	.	.	.	II ⁺¹	.	+	.	.	.	x	2/9 II+-1,+,11,12
* <i>Ranunculus pulchellus</i> C.A.Mey.	.	.	.	.	.	+	.	r	.	.	.	2/9 +,r
* <i>Calamagrostis holciformis</i> JB.et SP.	.	.	.	.	.	.	3	.	1	x	.	2/9 1-3,10
* <i>Aconogonon sibiricum</i> Laxm.ssp. <i>thomsonii</i>	.	.	.	.	.	.	+	.	1	.	.	2/9 +-1,12
* <i>Gentiana azurea</i> Bunge	.	.	.	.	.	.	.	r	2	.	.	2/9 r-2
* <i>Primula minutissima</i> Jacq.	III ⁺¹	.	.	.	.	.	.	.	.	.	.	1/9 III+-1
* <i>Trachydium roylei</i> Lindl.	III ⁺²	.	.	.	.	.	.	.	.	.	.	1/9 IIIr-2
<i>Gentiana carinata</i> Griseb.	+	.	.	.	.	.	.	.	.	.	.	1/9 +
<i>Koeleria cristata</i> (L.)Pers.	+	.	.	.	.	.	.	.	.	.	.	1/9 +
<i>Geranium himalayense</i> Klotzsch	.	IV ⁺³	.	.	.	.	.	.	.	.	.	1/9 IV+-3
<i>Artemisia brevifolia</i> Wall.s.l.	.	IV ⁺²	.	.	.	.	.	.	.	.	.	1/9 IV+-2
<i>Piptatherum laterale</i> (Munr.ex Regel)Rosh.	.	IV ⁺²	.	.	.	.	.	.	.	.	.	1/9 IV+-2
<i>Astragalus rhizanthus</i> Royle	.	II ¹⁻²	.	.	.	.	.	.	.	.	.	1/9 II1-2
<i>Silene moorcroftiana</i> Wall.	.	II*	.	.	.	.	.	.	.	.	.	1/9 II+
<i>Dianthus anatolicus</i> Boiss.	.	I*	.	.	.	.	.	.	.	.	.	1/9 II
* <i>Calamagrostis pulchella</i> Griseb.	.	I*	.	.	.	.	.	.	.	.	.	1/9 II
<i>Carex stenophylla</i> Wahlenb.	.	I*	.	.	.	.	.	.	.	x	.	1/9 I+,10
<i>Silene tenuis</i> Willd.	.	I*	.	.	.	.	.	.	.	.	.	1/9 I+
<i>Epilobium angustifolium</i> L.	.	I*	.	.	.	.	.	.	.	.	.	1/9 I+
* <i>Elymus dentatus</i> (Hook.f.)T.A.Cope	.	I*	.	.	.	.	.	.	.	.	.	1/9 I+
<i>Rheum webbianum</i> Royle	.	I*	.	.	.	.	.	.	.	.	.	1/9 I+
<i>Aconogonon rumicifolium</i> (Royle)Hara	.	I*	.	.	.	.	.	.	.	.	.	1/9 I+
<i>Delphinium cashmerianum</i> Royle	.	I*	.	.	.	.	.	.	.	.	.	1/9 I+
* <i>Oxytropis hypoglottoides</i> (Baker)Ali	.	.	.	.	.	.	.	4	.	.	.	1/9 4
* <i>Glaux maritima</i> L.	.	.	.	.	.	.	2	.	.	.	x	1/9 2,12
<i>Puccinellia himalaica</i> Tzvel.	.	.	.	.	.	.	1	.	.	.	.	1/9 1
* <i>Taraxacum leucanthum</i> Ledeb.	.	.	.	.	.	.	1	.	.	.	x	1/9 1,11
* <i>Lomatogonium thomsonii</i> (Clarke)Fern.	.	.	.	.	.	.	+	.	.	.	.	1/9 +

Grassland communities of the alpine and highalpine belt	Community dominated by <i>Kobresia schoenoides</i>	Community of <i>Nepeta discolor</i> / <i>Festuca kashmiriana</i>	<i>Poa attenuata</i> - <i>Potentilla sericea</i> community-group				Moist grassland at a plain	Higher <i>Kobresia</i> grassland	Carex grassland of Debring (Rupshu)	Incomplete species lists in grassland of the alpine belt		
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Table-nr. / Relevé-nr.	Tab.3	Tab.4	Tab.4	Tab.3	Tab.7	Tab.7	245	239	268	Rup-shu	W Karzok	
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Altitude in m (a.s.l.) x 10	433-438	433-446	487-530	470-515	468-493	475-517	450	520	483	480	456	456
Cover (Ø) %	79.2	66.2	67.5	66.3	75.6	74.0	100	95	100	-	-	-
pH of rhizosphere (Ø) / effective	4,6(13)	5,8(8)	6,7(4)	5,7(3)	6,5(7)	6,8(8)	8.0	-	-	-	-	-
Number of taxa (Ø) / effective	15.3	16.9	17.6	21.5	16.7	18.1	12	27	23	12	20	24
Areas in Ladakh	5	5	15, 16	12, 20	13, 14	14	15	15	16	16	18	18
Year of publication, 19..	90	90	97	99	90		97	97	97	97	99	99
* <i>Primula nutans</i> J.G.Georgi	+	1/9 +
* <i>Pedicularis heydei</i> Prain	1	.	.	.	1/9 1
* <i>Carex montis-everestii</i> Kükenthal	2	.	.	1/9 2
* <i>Pleurospermum hookeri</i> C.B.C.var. <i>thomsonii</i>	1	.	.	1/9 1
* <i>Saussurea taraxacifolia</i> Wall.var. <i>depressa</i>	1	.	.	1/9 1
* <i>Pleurospermum stellatum</i> Bth.var. <i>lindleyanum</i>	.	.	II ¹⁻²	.	.	.	.	.	.	.	.	1/9 II1-2
* <i>Elsholtzia eriostachya</i> Bth.var. <i>pusilla</i> Hook.f.	.	.	I ¹⁻²	.	.	.	.	.	.	.	.	1/9 I+2
* <i>Gentiana falcata</i> Turcz.	.	.	+	x	x	1/9 +,11,12
* <i>Gagea elegans</i> Wall.ex Don	.	.	+	1/9 +
* <i>Polygonum molliaeforme</i> Boiss.	.	.	+	1/9 +
* <i>Elymus schugnanicus</i> (Nevski)Tzvel.	.	.	.	III ¹⁻²	.	.	.	.	.	.	.	1/9 III+2
* <i>Waldheimia nivea</i> (Hook.f.et Th.)Regel	.	.	.	III ^r	.	.	.	.	.	.	.	1/9 IIIr
* <i>Saussurea glacialis</i> Herd.	.	.	.	II ²	.	.	.	.	.	.	.	1/9 II2
* <i>Lonicera spinosa</i> (Decne.)Walp.	.	.	.	II ²	.	.	.	.	.	.	.	1/9 II2
* <i>Saxifraga jacquemontiana</i> Dne.var. <i>stella-aurea</i>	.	.	.	II ¹	.	.	.	.	.	.	.	1/9 II1
* <i>Astragalus strictus</i> Grah.	.	.	.	II ¹	.	.	.	.	.	.	.	1/9 II1
* <i>Biebersteinia odora</i> Steph.	.	.	.	II ¹	.	.	.	.	.	.	.	1/9 II1
* <i>Chrysanthemum pyrethroides</i> Fedtsch.	.	.	.	II ¹	.	.	.	.	.	.	.	1/9 II1
* <i>Geranium cf. regelii</i> Nevski	.	.	.	II ¹	.	.	.	.	.	.	.	1/9 II1
* <i>Cicer microphyllum</i> Benth.	.	.	.	II ⁺	1/9 II+
* <i>Christolea crassifolia</i> Camb.	.	.	.	II ^r	.	.	.	.	.	.	.	1/9 IIr
* <i>Primula</i> sp.	.	.	.	II ^r	.	.	.	.	.	.	.	1/9 IIr
* <i>Poa pratensis</i> L.ssp. <i>pruinosa</i> (Kor.)Dickoré	III ¹⁻²	.	.	.	.	.	.	1/9 III1-2
* <i>Jurinea ceratocarpa</i> (Decne.)Benth.	I ⁺	1/9 I+
* <i>Oxytropis densa</i> Benth.ex Bunge	IV ⁺¹	.	.	.	.	.	1/9 IV+-1
* <i>Oxytropis chiliophylla</i> Royle ex Benth.	I ⁺	1/9 I+
* <i>Dracocephalum heterophyllum</i> Benth.	I ⁺	x	1/9 I+,12
* <i>Saxifraga cernua</i> L.fo. <i>bulbillosa</i> Engl.et Irm.	+	1/9 +
* <i>Christolea himalayensis</i> (Camb.)Jafri	+	1/9 +
* <i>Gentiana prostrata</i> Haenke	x	x	11.12
* <i>Ranunculus tricuspidis</i> Maxim.	x	x	11.12
* <i>Blysmus compressus</i> (L.)Panz.ex Link	x	.	11
* <i>Juncus thomsonii</i> Buchen.	x	.	11
* <i>Kobresia kashgarica</i> Dickoré	x	.	11
* <i>Kobresia pygmaea</i> C.B. Clarke	x	.	11
* <i>Parnassia pusilla</i> Wall.ex Arn.	x	.	11
* <i>Pedicularis longiflora</i> Rud.var. <i>tubiformis</i> Tsg.	x	.	11
* <i>Poa calliopsis</i> Litw.ex Ovcz.	x	.	11
* <i>Artemisia macrocephala</i> Jacq.ex Bess.	x	12
* <i>Artemisia stricta</i> Edgew.	x	12
* <i>Artemisia tournefortiana</i> Reichb.	x	12
* <i>Chenopodium pamaricum</i> Iljin	x	12
* <i>Elymus nutans</i> Griseb.	x	12
* <i>Hypocoum leptocarpum</i> Hook.f.et Th. C208	x	12
* <i>Leymus secalinus</i> (Georgi)Tzvel.	x	12
* <i>Pennisetum flaccidum</i> Griseb.	x	12
* <i>Poa tibetica</i> Munro ex Stapf	x	12
* <i>Stipa roborovskiyi</i> Roshev.	x	12
* <i>Suaeda olufsenii</i> Pauls.	x	12

* species listed only in this table

8. Systematic Enumeration of vascular plants collected in Ladakh, 1976–1997

8.1 General remarks

In all, 615 different taxa are listed. Enclosed in brackets, only few of the most important synonyms have been added.

The samples I have collected myself are labeled with a collection number with four digits (ranging from 2000 – to around 6100), printed in italics, underlined and without an added collector name. In exceptional cases where a known taxon was recorded and noted in the field without collecting it, the collection date has been added to the corresponding name of the author in brackets.

Added numbers in brackets are so-called relevé numbers, i.e. each one (Nr. 1 – 343) specifically refers to a relevé in which the corresponding species was noted, and especially also collected.

My own collecting activity was complemented and enriched by two existing collections, which I had the opportunity to view and partly also to identify. The first one was established by F. BILLIET and J. LÉONARD from the Jardin botanique national de Belgique (B-1860 Meise) between: 25. 06. and 16. 07. 1976. Their collection number is printed in italics, underlined, has four digits (> 6700) and stands next to the abbreviation *Bill. & Léon.*

The second collection originates from L. KLIMEŠ and M. SRŮTEK, Institute of Botany, Czech Academy of Sciences, Třeboň. Their journey, to which also K. PRACH from the same institution had joined, took place in late summer 1989. Since for this collection no numbers had been added to the taxa, beyond the abbreviation of the names *Klim. & Srut.* – and also at *K. Prach* – the collection date had been added.

Only few samples originate from Dr. *Mohamed Deen*, Leh; abbreviation: *M. Deen* (date of collection).

Of all the listed species, 400 are contained within relevés of the vegetation. For each taxon all communities are listed, in which it had been registered with an indication of its presence degree (steadiness): r – V and its cover-abundance (r – 5). The Tables 1 – 6 are the summarizing main Tables for the communities (s. chapter 6/7).

To all species, the life-form class according to the system of RAUNKIAER (in BRAUN-BLANQUET, 1964 p.146) has been added:

T	Therophytes	Ch	Chamaephytes
G	Geophytes	NP	Nanophanerophytes
H	Hemicryptophytes	P	Phanerophytes

The solidus between two species names – e.g. *Artemisia wellbyi* / *Lindelofia anchusoides* – indicates in general: and / or !

The complete collection is presently in my own possession. Doublets of a larger part of the taxa are at the Conservatoire et Jardin botaniques de Genève.

8.2 List of the vascular plants collected in Ladakh

Amaranthaceae

Amaranthus cf. *retroflexus* L.; possibly with an effect of *A. hybridus* L. 6078: Changspa, Leh, ca. 3600 m. T

Apiaceae (Umbelliferae)

Bupleurum gracillimum Klotzsch (*B. falcatum* var. *gracillimum* (Klotzsch) Wolff); 2009: SW above Dras, 3430 m, (Nr. 2). *Klim. & Srut.* (10. 9. 89): Fotu La, 3920 m. H

Table 2: - Community of *Koeleria cristata* / *Tanacetum artemisioides* II r-1
- Community dominated by *Artemisia brevifolia* II +-1

Bupleurum longicaule Wall. Ex DC. var. *himalayense* (Kl.) Clarke; 2006: valley E of Kartse (Suru), 4160 m, (Nr. 67). 2007: Sanmodangsa, 4190 m, (Nr. 86). *Klim. & Srut.* (30. 8. 89): SW Darcha, Lahul, 3650 m. H

Table 3: - *Bistorta affinis* community-group IV +-1
- Community-group of *Festuca kashmiriana* and *Poa suruana* +
- Grassland dominated by *Carex melanantha* V +-1
- Relevé in grassland dominated by *Kobresia schoenoides* and *Agrostis vinealis* 1

Bupleurum thomsonii C.B.Clarke; 2008: SE above Matayan, 3550 m, (Nr. 4). *Klim. & Srut.* (13. 9. 89): S Zoji La, 3330 m. H

Table 2: - Relevé within a transitional zone to the alpine belt on Fotu La 2

Table 3: - Relevé within community of *Koeleria cristata* and *Stipa pennata* ssp. *kirghisorum* +

Carum carvi L.; 2802: Tungri, Zanskar, 3600 m; 3129: N Leh, ca. 3600 m; especially in temporarily irrigated turfs. H

Chaerophyllum villosum Wall. (*Ch. reflexum* Lindl.); 2805: Tungri, Zanskar, 3600 m. H

Heracleum pinnatum C.B.Clarke; 2011: S above Matho, Indus Vy., 4030 m, (Nr. 54). *Klim. & Srut.* (13. 9. 89): below Dras, 3330 m. *M. Deen* (11. 8. 92): Sapi-Shergol. *Bill. & Léon. 6894*: Lamayuru, 3600 m; from personal observation not scarce at the N-side of Kongmaru La, 4200 – 4400 m (9. 8. 87). H

Table 1: - Communities of the higher subalpine desert r
- *Artemisia* steppe of a transitional zone to the alpine belt II r

Table 2: - Community dominated by *Artemisia brevifolia* +
- Community of *Artemisia brevifolia* / *Tanacetum fruticosum* II r-+
- Community of *Artemisia wellbyi* / *Lindelofia anchlussoides* II +-3
- *Stachys tibetica* community V r-1

Table 3: - *Artemisia brevifolia*-*Cicer microphyllum* community IV r-+

Table 4: - *Stipa glareosa*-*Krascheninnikovia pungens* community I +
- Relevé in a succession stage of *Artemisia wellbyi* +

Ligusticum thomsonii C.B.Clarke; 2801: Wakha Vy. S of Mulbekh, ca. 3700 m; 4194: NW above Leh, ca. 3630 m. H

Pleurospermum candollei (DC.) C.B.Clarke; *Klim. & Srut.* (1. 9. 89): Valley of Bhaga River, Lahul, 4520 m. H

Pleurospermum hookeri C.B.Clarke var. *thomsonii* Clarke; 4192: Debring, Rupshu, 4830 m, (Nr. 268). H

Table 6: - Relevé in grassland dominated by *Carex sagaensis* (Rupshu) 1

Pleurospermum stellatum Benth. var. *lindleyanum* (Kl.) C.B.Clarke; 4193: SE below Taglang La, Rupshu, 5050 m, (Nr. 266); 5082: Norbo, More Plain, 4800 m, (Nr. 308); 5083: Norbo, More Plain, 4860 m, (Nr. 309). H

Table 5: - *Caragana* community of the region of Taglang La – Rupshu II +-1

Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group II 1-2

Pleurospermum stylosum C.B.Clarke; 2803: Wakha Vy. SE Mulbekh, 3600 m. H

Prangos pabularia Lindl.; *Bill. & Léon. 6771*: between Zoji La and Dras very common, 3200 m. *H. Hartmann* (12. 7. 87): between Matayan and Dras many individuals in full flower near the road! H

Selinum papyraceum C.B.Clarke; 2012: W Sanmodangsa, Suru Vy., 4190 m, (Nr. 86). H

Table 3: - Grassland dominated by *Carex melanantha* IV 1
- Relevé in grassland dominated by *Kobresia schoenoides* and *Agrostis vinealis* +

Semenovia lasiocarpa (Boiss.) Manden. (*Platytaenia lasiocarpa* (Boiss.) Rech.f. et Riedl ssp. *thomsonii* (Clarke) Rech.f. et Riedl); 2010: SW above Dras, 3430 m, (Nr. 2). *Klim. & Srut.* (10. 9. 89): Fotu La, 3920 m. H

Table 1: - Communities of the higher subalpine desert I +2
 - - Relevé within a transitional zone to the alpine belt N of Likir +
 Table 2: - in most of the subalpine steppe communities +-III r-2
 Table 4: - *Aconogonon tortuosum*-*Nepeta glutinosa* community II +-1

Sium sisarum L.; 3130: Dras, 3200 m. H

Trachydium roylei Lindl.; 2804: Pensi La, 4360 m, (Nr. 161). H

Table 6: - Community dominated by *Kobresia schoenoides* III r-2

Apocynaceae

Trachomitum venetum ((L.)Woods.) ssp. *scabrum* (Russan.)Rech.f. (*Apocynum scabrum* Russanov); 4002: Nubra Vy., ca. 3000 m (leg. Ch. Nurbu, June 1992); ca. 1 m high ! G

Asclepiadaceae

Cynanchum acutum L.; 2063: E Khalsi, Indus Vy., 3150 m. H

Vincetoxicum canescens (Willd.)Decne. (*Cynanchum glaucum* Wall.); 2422: E Khalsi, Indus Vy., 3300 m.
Bill. & Léon. 6804: Khalsi, Indus Vy., 2950 m. H

Asteraceae (Compositae)

Anaphalis contorta (D.Don)Hook.f.; 4023: S Rohtang Pass, Lahul, ca. 3600 m. Ch,(H,G)

Anaphalis royleana DC.; 2499: near Dzongkhul Gompa, Zaskar, ca. 3800 m. Ch

Anaphalis triplinervis (Sims)Clarke var. *intermedia* (DC.)Airy Shaw and var. *monocephala* (DC.)Airy Shaw
 (*A. nubigena* auct.); 2068: W Sanku, Suru Vy., 4030 m, (Nr. 63); 2069: Valley E Kartse, Suru Vy., 3700 m;
4022: S Rohtang Pass, ca. 3600 m; 4021: Rohtang Pass, 4000 m. *Bill. & Léon. 6902*: between Sonamarg
 and Zoji La, 3250 m. *Klim. & Srut.* (1. 9. 89): Vy.of Bhaga River, Lahul, 4160 m and 4520 m; SW Darcha,
 Lahul, 3650 m. H,G

Table 3: - Relevé in grassland dominated by *Kobresia royleana* and *Leontopodium leontopodium* +

Anaphalis virgata Thoms.ex Clarke; 4024: below Götsang Gompa, Hemis, 3850 m; 2067: near Panikhar, Suru Vy., 3390 m, (Nr. 109). Ch

Table 2: - *Stachys tibetica* community I +
 - - Relevé in the low subalpine steppe-desert (W Ladakh) +

Artemisia brevifolia Wall. ex DC. (*A. maritima* auct. non L.); 2072: Yasghun, Dras Vy., 3520 m, (Nr. 7); 2073:
 N Panikhar, Suru Vy., 3470 m, (Nr. 74); 2071: SW Panikhar, 3790 m, (Nr. 107); 2490: SW above Tungri,
 Zaskar, 3760 m, (Nr. 153); 2491: Gel, Mulbekh, 3440 m, (Nr. 145); 4026: Phiyang, Indus Vy., 3650 m.
Klim. & Srut. (31. 8. 89): Bhaga River Vy., Lahul, 3170 m. Ch

Table 1: - Communities of the higher subalpine desert II r-2
 - *Artemisia* steppe of a transitional zone to the alpine belt IV 3
 - - Relevé in a depression +

Table 2: - in all communities of the subalpine steppe II-V r-4

Table 3: - *Bistorta affinis* community-group III +-3
 - *Artemisia brevifolia*-*Cicer microphyllum* community V +-4
 - Community-group of *Festuca kashmiriana* and *Poa suruana* III +-2

Table 4: - Community-group of *Elymus canaliculatus* and *Potentilla bifurca* II 1-3

Table 6: - Community of *Nepeta discolor* / *Festuca kashmiriana* IV +-2

Artemisia gmelinii Weber ex Steckm. (*A. sacrorum* Ledeb.) 2496: N Kanda La, 4570 m, (Nr. 134); 2074: Alchi Brok,
 Indus Vy., 4030 m, (Nr. 31); 3145: Tchatchutse, Markha Vy., 4560 m, (Nr. 196). *Klim. & Srut.* (12. 9. 89):
 E of Dras, 2930 m. Ch

Table 1: - *Artemisia* steppe of a transitional zone to the alpine belt V r-2

Table 2: - Community of *Artemisia brevifolia* / *Tanacetum fruticosum* II r-+
 - *Stachys tibetica* community I +-1

Table 4: - in most of the steppe and semidesert communities of the alpine belt +-V r-3

Table 5: - *Artemisia minor*-*Potentilla pamirica* community II 3
 - *Caragana* community of the region: Matho Phu – Kanda La – Nimaling III +-1

Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group +-II +

Artemisia macrocephala Jacq. ex Bess.; 5086: N Khardung La, 4440 m; 5087: Tso Kar, Rupshu, 4600 m. T

Table 4: - Community-group of *Potentilla bifurca* / *Artemisia gmelinii* +

Table 6: - Species list (12) from the catchment area of Tso Moriri

- Artemisia minor* Jacq.ex Bess. 2492: (cf.): Pensi La, 4360 m; 4027: N Taglang La, 4950 m, (Nr. 231); 5088: N of Khardung La, 4800 m. Ch
- Table 4: - Community-group of *Krascheninnikovia pungens* / *Ptilotrichum canescens* IV r-3
- *Stipa purpurea*-*Carex moorcroftii* community II 1-2
- Community-group of *Potentilla bifurca* / *Artemisia gmelinii* +
- Table 5: - *Artemisia minor*-*Potentilla pamarica* community V 2-3
- *Caragana* community of the region: Taglang La – Rupshu II 1-2
- Table 6: - *Poa attenuata*-*Potentilla pamarica* community-group +-II +
- Artemisia parviflora* Roxb. (*A. japonica* Thunb.); 2076: SE Matayan, Dras Vy., 3370 m, (Nr. 6). Klim. & Srut. (13. 9. 89): Zoji La, 3330 m. H
- Table 3: - Relevé in community of *Koeleria cristata* and *Stipa pennata* ssp. *kirghisorum* +
- Artemisia persica* Boiss.; 2493: Gel near Mulbekh, 3420 m, (Nr. 146); 2494: Wakha Vy. S Mulbekh, 3600 m. Klim. & Srut. (12. 9. 89): E Dras, 2960 m. Ch
- Table 2: - Community of *Koeleria cristata* / *Tanacetum artemisioides* +
- Relevé in the low subalpine steppe-desert (W Ladakh) r
- Artemisia scoparia* Waldst. et Kit.; 2498: Tungri, Zanskar, ca. 3600 m. H
- Table 2: - Relevé of a rock debris community devoid of or with only sporadic *Stachys tibetica* 1
- Artemisia sieversiana* Ehrh.ex Willd.; 2495: N Leh, 3550 m; 3144: N Leh, 3600 m. T,H
- Artemisia stracheyi* Hook.f. et Th.; 6003: Kiagar La, Rupshu, 4800 m. H
- Artemisia stricta* Edgew.; 2070: Matho Phu, Indus Vy., 4390 m, (Nr. 38); 3143: N Leh, 3600 m; 6002: Karzok, Tso Moriri, 4560 m. T
- Table 2: - Community of *Artemisia brevifolia* / *Tanacetum fruticosum* +
Table 4: - Community-group of *Elymus canaliculatus* and *Potentilla bifurca* V +-3
Table 5: - *Caragana versicolor* community of the region: Matho Phu – Kanda La I +
Table 6: - Incomplete species list (12) from the catchment area of Tso Moriri
- Artemisia tournefortiana* Reichb.; 5085: Nie, Indus Vy., 3780 m; 6001: Muglib, ca. 15 km W Pangong Tso, 4120 m. T
- Table 6: - Incomplete species list (12) from the catchment area of Tso Moriri
- Artemisia wallichiana* Besser; 4025: N Leh, 3700 m; 5089: N Tisseru near Leh, 3650 m; 5084: Khardung, Shyok-Vy., ca. 3800 m. H
- Artemisia wellbyi* Hemsl.et Pears. (*A. salsoloides* Willd.); 2075: W Sanku, Suru Vy., 3820 m, (Nr. 60); 2497: Dzongkhul, Zanskar, 3800 m, (Nr. 151); 6004: betw. Muglib and Pangong Tso, 4210 m, (Nr. 315). Ch
- Table 2: - Community dominated by *Artemisia brevifolia* +
- Community of *Artemisia brevifolia* / *Tanacetum fruticosum* I +
- Community of *Artemisia wellbyi* / *Lindelia anisodora* IV r-3
- Community on rock debris sites with and devoid of *Stachys tibetica* II +-3
- Table 3: - *Artemisia brevifolia*-*Cicer microphyllum* community I +
- Table 4: - *Stipa glareosa*-*Krascheninnikovia pungens* community II r-2
- *Stipa purpurea*-*Carex moorcroftii* community I 3
- Community-group of *Potentilla bifurca* / *Artemisia gmelinii* +
- Relevé in a succession stage of *Artemisia wellbyi* 2
- Aster flaccidus* Bunge ssp. *flaccidus* Griens.; 2078: Matho Phu, Indus Vy., 4930 m, (Nr. 52); 2500: Stok Phu, Indus-Vy., 4740 m, (Nr. 127); 3146: Nimaling, Markha Vy., 4870 m, (Nr. 202). Bill. & Léon. 6868: N Sabu, Indus Vy., 4800 m. Klim. & Srut.(2. 9. 89): Baralacha La, Lahul, 4640 m. H
- Table 3: - *Bistorta affinis* community-group IV +-1
- Relevé in community of *Koeleria cristata* and *Stipa pennata* ssp. *kirghisorum* +
- Relevé in community-group of *Festuca kashmiriana* and *Poa suruana* +
- Table 6: - in most of the communities of the alpine level II-IV +-2
- Aster flaccidus* Bunge ssp. *glandulosus* (Keissl.)Onno; 3147: Nimaling, Markha Vy., 4870 m, (Nr. 202).
- Brachyactis pubescens* (DC.)Aitch. (*Conyza pubescens* DC.); 2092: Sanmodangsa, Suru Vy., 3980 m, (Nr. 91). T,H
- Table 3: - Community-group of *Festuca kashmiriana* and *Poa suruana* II +
- Relevé in grassland dominated by *Kobresia schoenoides* and *Agrostis vinealis* +
- Brachyactis roylei* (DC.)Wend. (*B. umbrosa* (Kar. et Kir.)Benth.); 2093: Alchi Brok, Indus Vy., 4030 m, (Nr. 31); 2501: E above Rumbak, 4200 m; 5090: Nie, Indus Vy., 3800 m. T,H
- Table 2: - *Stachys tibetica* community III +-1

- Community of *Artemisia wellbyi* / *Lindelofia anchlussoides* II 1
- Community devoid of or with only sporadic *Artemisia brevifolia* I +
- Relevé of the *Koeleria cristata* community +

? *Chrysanthemum griffithii* C.B.Clarke; 2082: N Panikhar, Suru Vy., 3350 m, (Nr. 72); 2505: E Parkutse, Suru Vy., 3450 m. Ch

Table 2: - Community of *Artemisia wellbyi* / *Lindelofia anchlussoides* +

? *Chrysanthemum pyrethroides* (Kar. & Kir.)Fedtsch.; 2503: W Stok La, 4700 m; 5091: Norbo, More Plain, 4840 m, (Nr. 307). *Klim. & Srut.* (10. 9. 89): Fotu La, 3920 m. H,(Ch)

Table 4: - Community of *Stipa breviflora* / *Tanacetum fruticosum* I +
 - Community-group of *Potentilla bifurca* / *Artemisia gmelinii* I r-+
 - Relevé in a succession stage of *Artemisia wellbyi* 1

Table 5: - *Caragana* community of the region: Taglang La – Rupshu II +-1

Table 6: - *Poa attenuata*-*Potentilla pamiirica* community-group II 1

? *Chrysanthemum pyrethroides* var. *tomentosa* Regel (= *Tanacetum stoliczkae* ?); 2504: Wakha Vy. S Mulbekh, 3650 m; 2081: Mulbekh, 3740 m, (Nr. 10). *Bill. & Léon. 6838*: Götsang Gompa above Hemis, 4000 m. H,(Ch)

Table 2: - Community of *Koeleria cristata* / *Tanacetum artemisioides* III +-2
 - Community of *Artemisia brevifolia* / *Tanacetum fruticosum* +
 - Relevé within a transitional zone to the alpine belt on Fotu La +

? *Chrysanthemum tibeticum* Hook.f. et Th. (= *Tanacetum stoliczkae* ?); 3148: N of Kongmaru La, ca. 4200 m; 5092: S above Hemis, 3940 m. Ch

Cirsium arvense (L.)Scop. var. *incanum* (Fisch.)Led.; 2511: Mulbekh, 3200 m. G

Cousinia thomsonii C.B.Clarke; 2091: S above Namika La, 3950 m, (Nr. 17); 2512: near Dzongkhul Gompa, Zanskar, ca. 3700 m. H

Table 2: - in most of the subalpine steppe communities I-II r-+

Table 3: - *Bistorta affinis* community-group I +

Cremanthodium ellisii (Hook.f.)Kitam.; 3149: N below Kongmaru La, 4850 m; 4031: NE of Taglang La, 5200 m; 5093: S below Khardung La, 4950 m; 4032: Rohtang Pass, Lahul, 4000 m. *Klim. & Srut.* (1. 9. 89): Lahul, 4520 m. H

Table 6: - *Poa attenuata*-*Potentilla pamiirica* community-group II +
 - Relevé within higher *Kobresia* grassland 1

Crepis flexuosa (DC.)Benth. et Hook.f.; 2089: Alchi Brok, Indus Vy., 4110 m, (Nr. 33); 2090: Mulbekh, 3300 m, (Nr. 19); 3151: W of Yangtang, 3700 m, (Nr. 188). H,G:

Table 1: - in most of the subalpine desert communities +-III+-2

Table 2: - *Stachys tibetica* community II +
 - Community of *Artemisia brevifolia* / *Tanacetum fruticosum* I +-1
 - Community of *Koeleria cristata* / *Tanacetum artemisioides* +
 - Community of *Artemisia wellbyi* / *Lindelofia anchlussoides* +

Table 4: - *Aconogonon tortuosum*-*Nepeta glutinosa* community III +
 - *Stipa glareosa*-*Krascheninnikovia pungens* community II r-1
 - Community-group of *Krascheninnikovia pungens* / *Ptilotrichum canescens* I +
 - Community-group of *Elymus canaliculatus* and *Potentilla bifurca* +

Crepis multicaulis Ledeb. ssp. *congesta* (Regel)Babc.; 5108: S Khardung La, 4530 m, (Nr. 290). H

Table 4: - Community-group of *Potentilla bifurca* / *Artemisia gmelinii* +

Echinops cornigerus DC. (*Echinops tibeticus* Bunge); 5094: W Tisseru near Leh, ca. 3600 m. G

Table 1: - Desert communities of the lower and higher subalpine belt II-IV r-1

Table 2: - Relevé in *Stachys tibetica* community r
 - Relevés in the low subalpine steppe-desert (W Ladakh) +

Erigeron bellidioides Benth.sensu Hook.f.; 2515: Khalsi, Indus Vy., 3300 m. H

Erigeron multicaule DC.; 2516: Wakha Vy., SE of Mulbekh, ca. 3350 m. H

Erigeron multiradiatus (DC.)Benth. et Hook.f.; 2077: S Matayan, Dras Vy., 3550 m, (Nr. 4); 2079: N above Sanmodangsa, Suru Vy., 4190 m, (Nr. 87). H

Erigeron uniflorus L.; 5095: S Khardung La, Indus Vy., ca. 4920 m. H

Filago arvensis L. 2088a: SW above Sanku, Suru Vy., 3460 m, (Nr. 58). T

- Table 2: - Community devoid of or with only sporadic *Artemisia brevifolia* III r-+
 - *Stachys tibetica* community I +
 - - Relevé of a rock debris community devoid of or with only sporadic *Stachys tibetica* +
 - - Relevé in the low subalpine steppe-desert (W Ladakh) I
- Filago hurdwarica*** (DC.)Wagenitz (*F. spatulata* auct.); 2088b: same stand as *F. arvensis* (Nr. 58). T
- Heteropappus semiprostratus*** Griens.; 2080: Matho Phu, Indus Vy., 4380 m, (Nr. 39); 6005: ca. 8 km E of Check Poste Chang La, 4710 m, (Nr. 320). H,(G)
- Table 4: - Community-group of *Elymus canaliculatus* and *Potentilla bifurca* +
- Hieracium prenanthoides*** Vill.; 2087: SE above Matayan, Dras Vy., 3550 m, (Nr. 4). H
- Table 3: - Relevé in the community of *Koeleria cristata* and *Stipa pennata* ssp.*kirghisorum* +-1
- Hieracium umbellatum*** L.; 2086: N above Sanmodangsa, Suru Vy., 4200 m; 2507: Wakha Vy. SE of Mulbekh, ca. 3600 m. H
- Table 2: - Community dominated by *Artemisia brevifolia* +
 Table 3: - *Bistorta affinis* community-group I r
- Inula obtusifolia*** Kerner; 2085: W Saspol, Indus Vy., 3200 m; 2508: above Tungri, Zaskar, 3650 m. Bill. & Léon. 6809: Khalsi, Indus Vy., 2950 m. H
- Table 1: - Desert communities of the higher subalpine belt r
- Inula racemosa*** Hook.f. (*I. royleana* Clarke); 2509: Wakha Vy. SE of Mulbekh, ca. 3650 m. H
- Inula rhizocephala*** Schrenk var. *rhizocephaloides* (Clarke)Kit.; 2084: W above Sanku, Suru Vy., 3880 m, (Nr. 61). H
- Table 3: - Relevés in grassland dominated by *Kobresia royleana* and *Leontopodium leontopodium* +
- Jurinea ceratocarpa*** (Decne.)Benth.; 2531: E Parkutze, Suru Vy., 3500 m. H
- Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group I +
- Jurinea ceratocarpa*** var. *depressa* Clarke; 2066: E Kartse, Suru Vy., 3790 m, (Nr. 65); 6006: N Phiyang, Indus Vy. ca. 4200 m. H
- Table 2: - Relevés of the *Koeleria cristata* community 1/+
 Table 3: - *Bistorta affinis* community-group I +
- Koelpinia linearis*** Pallas; 2083: Mulbekh, 3250 m, (Nr. 20); 2514: Tungri, Zaskar, 3600 m. T
- Table 2: - Community dominated by *Artemisia brevifolia* I 1
- Lactuca dissecta*** D.Don; 2518: E Khalsi, Indus Vy., 3300 m. T
- Lactuca orientalis*** Boiss.; 3152: NW Yangtang, 3720 m, (Nr. 189). Klim. & Srut. (13. 9. 89): ca. 15 km E of Dras, 3330 m. H,(Ch,G)
- Table 1: - Desert communities of the higher subalpine belt I +-1
 Table 2: - Relevés in the low subalpine steppe-desert (W Ladakh) 1/+
- Lactuca tatarica*** (L.)C.A.Mey. var. *tibetica* Hook.f.; 2517: N above Leh, ca. 3550 m. H,(G)
- Table 2: - Community of *Artemisia wellbyi* / *Lindelofia anchusoides* +
 - - Relevé in the low subalpine steppe-desert (W Ladakh) +
- Lactuca undulata*** Ledeb.; Klim. & Srut. (8. 9. 89): Saspol, Indus Vy., 3170 m. T
- Leontopodium leontopodium*** (DC.)Hand.-Mazz. (*L. ochroleucum* Beauv.): 2105: SE Matayan, Dras Vy., 3450 m, (Nr. 5); 2106: S above Matayan, 3550 m, (Nr. 4); 2104: Mulbekh, 3570 m, (Nr. 12); 2541: Pensi La, 4370 m, (Nr. 165). Klim. & Srut. (30. 8. 89): SW Darcha, Lahul, 3650 m. H
- Table 2: - Community dominated by *Artemisia brevifolia* III +-3
 - Community of *Artemisia brevifolia* / *Tanacetum fruticosum* +
 - Community devoid of or with only sporadic *Artemisia brevifolia* I +
 - Community of *Koeleria cristata* / *Tanacetum artemisioides* III +-1
 - - Relevé of the *Koeleria cristata* community +
- Table 3: - very important in the *Bistorta affinis* community-group V +-3
 - in most of the other communities I 1 and +-2
- Table 4: - Community-group of *Potentilla bifurca* / *Artemisia gmelinii* II +-2
 - Community-group of *Elymus canaliculatus* and *Potentilla bifurca* II r-+
 - *Aconogonon tortuosum*-*Nepeta glutinosa* community I 1
- Table 6: - Community dominated by *Kobresia schoenoides* V +-2
 - *Poa attenuata*-*Potentilla pamirica* community-group II 1
 - Community of *Nepeta discolor* / *Festuca kashmiriana* I 2

- - Incomplete species list (10) from Lachalung La (Rupshu)

Leontopodium monocephalum Edgew.; 3153: Ang, ca. 3500 m; 4033: N Leh, 3650 m; 5096: Panamik, Nubra, ca. 3230 m. H

Leontopodium nanum (Hook.f. et Th.)Hand.-Mazz.; 2103: Matho Phu, Indus Vy., 4930 m, (Nr. 52); 2542: Stok Phu, Indus Vy., 4740 m, (Nr. 127); 3154: Nimaling, Markha Vy., 4860 m, (Nr. 201); 4034: S Taglang La, 5050 m, (Nr. 261); 4035: N Taglang La, 4950 m, (Nr. 231); 5097: E Khardung La, 5100 m, (Nr. 287). H

Table 4: - Community-group of *Potentilla bifurca* / *Artemisia gmelinii* +

Table 5: - *Artemisia minor*-*Potentilla pamirica* community II 3

- *Caragana* community of the region: Taglang La - Rupshu I +

Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group IV-V +-3

- - Relevé within higher *Kobresia* grassland I

- - Species list (11) from the catchment area of Tso Moriri

Picris nuristanica Bornm. (*P. hieracioides* auct. non L.); 2506: Wakha Vy. SE Mulbekh, ca. 3600 m. H

Psychrogeton andryaloides (DC.)Novopokr. var. ***andryaloides*** Griens.; 2102: SW Dras, 3450 m, (Nr. 1); 2520: SW Tungri, Zaskar, 3870 m, (Nr. 154); 5098: N Khardung La, Shyok Vy., 4440 m, (Nr. 282); *Bill. & Léon. 6792*: between Namika La and Fotu La, 3600 m. *Klim. & Srut.* (31. 8. 89): Bhaga Riv. Vy., Lahul, 3250 m; (1. 9. 89): 4160 m. H

Table 2: - in all communities of the subalpine steppe I-V r-2

Table 3: - *Artemisia brevifolia*-*Cicer microphyllum* community I +

- Community-group of *Festuca kashmiriana* and *Poa suruana* I r-+

Table 4: - Community-group of *Elymus canaliculatus* and *Potentilla bifurca* II +-1

- Community-group of *Potentilla bifurca* / *Artemisia gmelinii* II +-2

- - Relevé in *Aconogonon tortuosum*-*Nepeta glutinosa* community +

Psychrogeton andryaloides var. ***denudatus*** (Botsch)Griens.; 2519: Pensi La, Suru/ Zaskar, 4360 m. H

Table 6: - Community of *Nepeta discolor* / *Festuca kashmiriana* V +-2

- Community dominated by *Kobresia schoenoides* III +-1

Saussurea candolleana (Wall. ex DC.)Clarke; 2095: N above Sanmodangsa, Suru Vy., 4050 m, (Nr. 93). H

Table 3: - Relevé in grassland dominated by *Kobresia schoenoides* and *Agrostis vinealis* +

Saussurea falconeri Hook.f.; 2096: E Kartse, Suru Vy., 4160 m, (Nr. 67); 2533: Pensi La, 4360 m, (Nr. 161); 2532: Pensi La, 4380 m, (Nr. 175). H

Table 3: - *Bistorta affinis* community-group IV +-1

- Grassland dominated by *Carex melanantha* II +

- Community-group of *Festuca kashmiriana* and *Poa suruana* +

Table 6: - Community dominated by *Kobresia schoenoides* IV +-1

- Community of *Nepeta discolor* / *Festuca kashmiriana* III +-1

- *Poa attenuata*-*Potentilla pamirica* community-group II +

Saussurea* cf. ***glacialis** Herd.; 2094: Matho Phu, Indus Vy., 4930 m, (Nr. 52); 3159: Nimaling, Markha Vy., 5170 m, (Nr. 204); 5102: N Khardung La, 5100 m. H,G

Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group II 2

Saussurea glanduligera Schultz-Bip.; 3156: N Kongmaru La, ca. 4500 m; 4038: above Rumtse, 4650 m, (Nr. 235). H

Table 4: - Community-group of *Krascheninnikovia pungens* / *Ptilotrichum canescens* I +

Saussurea gnaphalodes (Royle)Sch.-Bip. 3155: S Kongmaru La, 5100 m, (Nr. 212); 5101: Lachalung La, Rupshu, 5070 m. *Klim. & Srut.* (2. 9. 89): Baralacha La, 4640 m; (1. 9. 89): Bhaga Riv.-Vy., Lahul, 4520 m. H,G

Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group II-III +-2

- - Relevé within higher *Kobresia* grassland +

Saussurea jacea (Klotzsch)Clarke; 2098: W Sanku, Suru Vy., 3820 m, (Nr. 60). H

Table 2: - Community of *Artemisia wellbyi* / *Lindelia anchusoides* +

Saussurea nana (Pamp.)Pamp.; 3158: Nimaling, Markha Vy., 4860 m, (Nr. 201); 3157: Nimaling, 5170 m, (Nr. 204); 4037: Debring, Rupshu, 4950 m; (Nr. 267); 5099: NE Lachalung La, Rupshu, 4950 m. H,(G)

Table 5: - *Artemisia minor*-*Potentilla pamirica* community V +-1

- *Caragana* community of the region: Taglang La - Rupshu III +-1

Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group IV +-2

- - Relevé within higher *Kobresia* grassland I

- - Species list (10) from Lachalung La (Rupshu)

Saussurea stoliczkaei C.B.Clarke; 2097: Matho Phu, Indus Vy., 4930 m, (Nr. 52); 5100: S Khardung La, ca. 4920 m.

- Klim. & Srut.* (1. 9. 89): Vy. of Bhaga Riv., Lahul, 4520 m. H
- Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group II +
- Saussurea taraxacifolia*** Wall.ex DC. cf. var. *depressa*; 4036: Debring, Rupshu, 4830 m, (Nr. 268). H
- Table 6: - Relevé in grassland dominated by *Carex sagaensis* (Rupshu) 1
- Scorzonera virgata*** DC.; 2100: S Fotu La, 4200 m, (Nr. 23); 2099: SW Dras, 3450 m, (Nr. 1); 2101: Sanmodangsa, Suru Vy., 4040 m, (Nr. 82). 6007: Valley N of Phiyang, Indus Vy., 4200 m, (Nr. 339). *Klim. & Srut.* (31. 8.89): Vy. of Bhaga Riv., Lahul, 3170 m; (10. 9. 89): Fotu La, 3890 m. H
- Table 2: - in all subalpine steppe communities I-V +-1
- Table 3: - in all communities of subalpine turf and steppe-meadows III-V +-1
- Senecio dubius*** Ledeb.; 2120: Alchi Brok, Indus Vy., 4110 m, (Nr. 33). *Bill. & Léon.*: 6889: E Khalsi, Indus Vy., 3150 m. *K. Prach* (31. 8. 89): Vy. of Bhaga Riv., Lahul, 3250 m. T
- Table 2: - Community of *Koeleria cristata* / *Tanacetum artemisioides* +
- *Stachys tibetica* community I r
- Table 4: - *Aconogonon tortuosum*-*Nepeta glutinosa* community IV +
- Senecio krascheninnikovii*** Schischk.; 2536: N of Leh, 3560 m; 3160: N above Leh, 3600 m; 4040: N above Leh, ca. 3700 m. T
- Table 1: - Relevé in a depression of the subalpine desert +
- Senecio laetus*** Edgew.; 2534: Wakha Vy., SE Mulbekh, ca. 3600 m; 3161: Dras, 3200 m; 4039: S Rohtang Pass, ca. 3600 m. H
- Soroseris deasyi*** (S.Moore)Stebbins; 2530: E of Stok La, Indus Vy., 4750 m. H
- Tanacetum artemisioides*** Schultz-Bip.; 2117: SE Mulbekh, 3570 m, (Nr. 12); 2521: Wakha Vy., SE Mulbekh, 3440 m, (Nr. 145). *Bill. & Léon.* 6777: Dras, 3100 m. Ch
- Table 2: - Community of *Koeleria cristata* / *Tanacetum artemisioides* III 2
- - Relevé in the low subalpine steppe-desert (W Ladakh) 2
- Tanacetum fruticosum*** Ledeb. (*T. gracile* Hook.f.et Th.); 2119: N Khalsi, Indus Vy., 3210 m, (Nr. 21); 2522: Leh, 3640 m, (Nr. 114); 2523: Yurutse, S Kanda La, 4180 m, (Nr. 144); 3162: NE Yangtang, 3720 m, (Nr. 183); 3164: Tchatchutse, Markha Vy., 4550 m, (Nr. 195); 3163: Shingo, Markha Vy., 4150 m; 4028: Sabu, 3780 m, (Nr. 213); 4029: Runtse, 4450 m, (Nr. 229); 2118: S Matho, Indus Vy., 4030 m, (Nr. 54). Ch
- Table 1: - in all communities of the subalpine desert II-V r-3
- Table 2: - Community of *Artemisia brevifolia* / *Tanacetum fruticosum* V +-3
- *Stachys tibetica* community III 1-3
- Relevé of the *Koeleria cristata* community +
- Table 3: - *Bistorta affinis* community-group II r
- Table 4: - Community of *Stipa breviflora* / *Tanacetum fruticosum* V +-3
- Community-group of *Krascheninnikovia pungens* / *Ptilotrichum canescens* II 2-3
- Community-group of *Potentilla bifurca* / *Artemisia gmelinii* II +-3
- *Stipa glareosa*-*Krascheninnikovia pungens* community IV +-3
- Tanacetum longifolium*** Wall. Ex DC.; 2113: N above Sanmodangsa, Suru Vy., 4050 m, (Nr. 93). H
- Table 2: - Community dominated by *Artemisia brevifolia* I +
- Table 3: - *Bistorta affinis* community-group I +
- - Relevé in grassland dominated by *Kobresia schoenoides* and *Agrostis vinealis* 1
- Tanacetum senecionis*** (Jacq. ex Bess.)DC. (*T. tomentosum* DC.); 2116: W above Sanmodangsa, Suru Vy., 4190 m, (Nr. 87); 2115: SW above Dras, 3430 m, (Nr. 2); 2528: Pensi La, 4410 m, (Nr. 167); 2527: SW above Tungri, Zanskar, 4120 m, (Nr. 156). *Klim. & Srut.* (30. 8. 89): SW Darcha, Lahul, 3650 m. H
- Table 2: - Community of *Koeleria cristata* / *Tanacetum artemisioides* I r-+
- Community dominated by *Artemisia brevifolia* I +
- Table 3: - *Bistorta affinis* community-group V +-1
- Community-group of *Festuca kashmiriana* and *Poa suruana* +-2
- - Relevé in community of *Koeleria cristata* and *Stipa pennata* ssp. *kirghisorum* 1
- Table 6: - Community of *Nepeta discolor* / *Festuca kashmiriana* II 1
- Community dominated by *Kobresia schoenoides* +
- Tanacetum tibeticum*** Hook.f. et Th.; 2114: Matho Phu, Indus Vy., 4900 m, (Nr. 51); 2525: Stok Phu, Indus Vy., 4550 m, (Nr. 120); 2524: Stok Phu, 4620 m, (Nr. 121); 2526: Kanda La, 4850 m, (Nr. 137); 3165: Nimaling, Markha Vy., 5170 m, (Nr. 204); 4030: Debring, Rupshu, 5050 m, (Nr. 266); 5103: Norbo, More Plain, 4840 m, (Nr. 307); 5104: N of Khardung La, ca. 4750 m. Ch,(H)
- Table 4: - Community-group of *Elymus canaliculatus* and *Thermopsis inflata* / *Biebersteinia odora* II +-1

- Community-group of *Krascheninnikovia pungens* / *Ptilotrichum canescens* I r
- Community-group of *Elymus canaliculatus* and *Potentilla bifurca* +
- Table 5: - *Artemisia minor*-*Potentilla pamiica* community II 1
- *Caragana* communities of the region of Taglang La - Rupshu as well as Matho Phu and Kanda La I-III +-1
- Table 6: - *Poa attenuata*-*Potentilla pamiica* community-group I-III +-1

Taraxacum cf. *bicolor* DC.; 2109: SE above Matayan, Dras Vy., 3370 m, (Nr. 6); 3166: E of Markha, 4150 m. H

Table 3: - Community of *Koeleria cristata* and *Stipa pennata* ssp. *kirghisorum* +

Taraxacum cf. *brevirostre* Hand.-Mazz.; 5105: S Khardung La, Indus Vy., 4530 m, (Nr. 290). H

Taraxacum erioscapum Hartmann sp. nov.; 2502: Stok Phu, Indus Vy., 4500 m (Typus!). H

Taraxacum leucanthum Ledeb.; 4041: above Runtse, N Taglang La, 4500 m; 4042: N above Leh, 3670 m. H

Table 6: - Relevé in moist grassland at a plain 1
- Incomplete species list (11) from the catchment area of Tso Moriri

Taraxacum cf. *pseudoleucanthum* v. Soest; 2544: Mulbekh, ca. 3150 m. H

Taraxacum cf. *pseudo-stenolepium* v. Soest; 2111: SE Matayan, Dras Vy., 3450 m, (Nr. 5); 2112: S above Matayan, 3550 m, (Nr. 4). H

Table 3: - Relevés in the community of *Koeleria cristata* and *Stipa pennata* ssp. *kirghisorum* r-+
- Relevé in a transitional zone between subalpine steppe and *Bistorta affinis* community +

Taraxacum sp.; 2110: SW above Dras, 3430 m, (Nr. 2). H

Tragopogon dubius Scop.; 2108: SE above Matayan, Dras Vy., 3550 m, (Nr. 4). H

Table 3: - Relevés in community of *Koeleria cristata* and *Stipa pennata* ssp. *kirghisorum* +

Waldheimia nivea (Hook.f. et Th.) Regel; 5107: N Khardung La, Shyok Vy., 4750 m. H,(G)

Table 6: - *Poa attenuata*-*Potentilla pamiica* community-group III r

Waldheimia tridactylites Kar. et Kir. (*W. glabra* (Dcne.) Regel); 2107: Matho Phu, Indus Vy., 4900 m, (Nr. 51); 5106: N Khardung La, Shyok Vy., 4750 m. Klim. & Srut. (1. 9. 89): Bhaga Riv.-Vy., Lahul, 4160 m. H,(G)

Table 6: - *Poa attenuata*-*Potentilla pamiica* community-group +-III +-2
- Community dominated by *Kobresia schoenoides* II +

Youngia tenuifolia (Willd.) Bab. et Steb. ssp. *diversifolia* (Ledeb.) Bab. et Steb.; 3150: Tchatchutse, Markha Vy., 4340 m, (Nr. 199). H

Table 1: - Desert communities of the higher subalpine belt +

Table 4: - Community of *Stipa breviflora* / *Tanacetum fruticosum* I +

Balsaminaceae

Impatiens glandulifera Royle; 3134: Dras, 3200 m. T

Impatiens thomsonii Hook.f. ssp. *thomsonii* Y.I. Nasir; 3133: Tingsmogang, Indus Vy., 3400 m. T

Berberidaceae

Berberis ulicina Hook.f. et Th.; 3054: Chaluk, Markha Vy., ca. 3750 m. NP

Table 2: - Community of *Artemisia brevifolia* / *Tanacetum fruticosum* I r

Betulaceae

Betula utilis D. Don; ssp. *jacquemontii* (Spach) Kit.; 2730: Wakha Vy. SE Mulbekh, ca. 3750 m. P

Boraginaceae

Arnebia euchroma (Royle) J.M. Johnston. var. *euchroma* Kazmi (*Macrotomia perennis* Boiss.); 2318: Sanmodangsa, Suru Vy., 3940 m, (Nr. 83). H

Table 2: - Community dominated by *Artemisia brevifolia* III r-+
- Community of *Koeleria cristata* / *Tanacetum artemisioides* II r-1
- *Stachys tibetica* community I r
- Community of *Artemisia brevifolia* / *Tanacetum fruticosum* +
- Community of *Artemisia wellbyi* / *Lindelofia anchusoides* +
- Relevés within the transitional zone to the alpine belt on Fotu La +

Table 3: - *Artemisia brevifolia*-*Cicer microphyllum* community II +
- Community-group of *Festuca kashmiriana* and *Poa suruana* +

- Table 4: - *Aconogonon tortuosum*-*Nepeta glutinosa* community I r
- *Stipa glareosa*-*Krascheninnikovia pungens* community +
- Arnebia guttata*** Bunge; 2319: Leh, 3600 m; 3135: N above Leh, 3650 m. *Bill. & Léon. 6802*: Lamayuru, 3600 m; 6845: Tikse, 3400 m. *Klim. & Srut.* (4. 9. 89): Upshi, Indus Vy., 3390 m. H
- Table 1: - Communities of the higher subalpine desert II r-1
- Table 2: - Community of *Artemisia brevifolia* / *Tanacetum fruticosum* +
- Table 4: - *Stipa glareosa*-*Krascheninnikovia pungens* community II r+
- Cynoglossum glochidiatum*** Wall. ex Benth.; 2314: W Panikhar, Suru Vy., 3350 m, (Nr. 108); 2315: N Panikhar, 3350 m, (Nr. 72); 3137: S Tingsmogang, Indus Vy., ca. 3400 m. *Bill. & Léon. 6764*: betw. Zoji La and Dras, 3300 m. *Klim. & Srut.* (13. 9. 89): E of Dras, 3330 m. H
- Table 2: - Community of *Artemisia wellbyi* / *Lindelofia anchusoides* II +-1
- *Stachys tibetica* community II +
- Community dominated by *Artemisia brevifolia* +
- - Relevé from a rock debris community devoid of or with only sporadic *Stachys tibetica* +
- Eritrichium canum*** (Benth.)Kitam.; 2313: S Mulbekh, 3740 m, (Nr. 10); 2443: SW Tungri, Zanskar, 4120 m, (Nr.156); 2442: E Kanda La, 4540 m, (Nr. 141); 5029: S above Hemis, ca. 3900 m. H
- Table 2: - Community of *Koeleria cristata* / *Tanacetum artemisioides* IV +-2
- *Stachys tibetica* community on rock debris IV +-1
- Community dominated by *Artemisia brevifolia* I-III +-1
- Community of *Artemisia brevifolia* / *Tanacetum fruticosum* II r+
- - Relevé within the transitional zone to the alpine belt on Fotu La 1
- Table 4: - Community-group of *Elymus canaliculatus* and *Potentilla bifurca* II-IV r-1
- Community-group of *Potentilla bifurca* / *Artemisia gmelinii* IV r-1
- *Aconogonon tortuosum*-*Nepeta glutinosa* community II +-2
- Table 5: - *Caragana* community of the region: Kanda La and Matho Phu II +-1
- Eritrichium villosum*** (Ledeb.)Bunge (*E. nanum* (Vill.)Schrader. ssp. *villosum* (Ledeb.)Brand); *Klim. & Srut.* (1. 9. 89): Bhaga Riv.-Vy., Lahul, 4160 m. Ch
- Lappula barbata*** (M.Bieb.)Gürke; *Klim. & Srut.* (31. 8. 89): Bhaga Riv.-Vy., Lahul, 3170 m. T,(H)
- Lappula heterantha*** (Ledeb.)Gürke; 2444: N above Leh, ca. 3600 m; 3136: N Leh, ca. 3650 m; 6008: ca. 9 km E of Tsoltak (N Chang La), 4780 m, (Nr. 325). T,H
- Table 2: - Community of *Artemisia brevifolia* / *Tanacetum fruticosum* I r+
- Table 4: - Community-group of *Potentilla bifurca* / *Artemisia gmelinii* +
- Lindelofia anchusoides*** (Lindl.)Lehm.; 2321: S Matayan, Dras Vy., 3550 m, (Nr. 4); 2322: N Panikhar, Suru Vy., 3350 m, (Nr. 72); 2445: Dzongkhul, Zanskar, 3830 m, (Nr. 152); (8. 8. 87): N of Kongmaru La up to ca. 4900 m very common! *Klim. & Srut.* (31. 8. 89): Bhaga Riv.-Vy., Lahul, 3250 m. H
- Table 2: - Community of *Artemisia wellbyi* / *Lindelofia anchusoides* IV +-4
- Community dominated by *Artemisia brevifolia* II +
- Table 3: - *Artemisia brevifolia*-*Cicer microphyllum* community V +-2
- Community-group of *Festuca kashmiriana* and *Poa suruana* III +
- *Bistorta affinis* community-group I r
- Community of *Koeleria cristata* and *Stipa pennata* ssp. *kirghisorum* +
- Lindelofia stylosa*** (Kar.et Kir.)Brand; 2320: Alchi Brok, Indus Vy., 4160 m, (Nr. 34); 2447: Pensi La, 4380 m, (Nr. 162); 2446: E Rumbak, Indus Vy., 4500 m. H
- Table 4: - *Aconogonon tortuosum*-*Nepeta glutinosa* community IV +-1
- Community-group of *Elymus canaliculatus* and *Potentilla bifurca* +
- Community-group of *Potentilla bifurca* / *Artemisia gmelinii* +
- Table 5: - *Caragana* community of the region of Kanda La and Matho Phu II r
- Table 6: - Community of *Nepeta discolor* / *Festuca kashmiriana* +
- Community dominated by *Kobresia schoenoides* +
- Mattiastrum himalayense*** (Klotzsch)Brand; 2310: S Mulbekh, 3310 m, (Nr. 13); 2448: Tungri, Zanskar, 3640 m, (Nr. 149); 3138: Ang, 3500 m, (Nr. 192). *Bill. & Léon. 6784*: Kargil, 2950 m. H
- Table 1: - Communities of the higher subalpine desert +
- Table 2: - Steppe community devoid of or with only sporadic *Artemisia brevifolia* II +
- Community of *Artemisia wellbyi* / *Lindelofia anchusoides* II +
- - Relevé in the low subalpine steppe-desert (W Ladakh) +
- Mattiastrum tibeticum*** (C.B.Clarke)Brand; *Klim. & Srut.* (9. 9. 89): Khalsi, Indus Vy., 2900 m. H
- Microula tibetica*** Benth.; 2311: Matho Phu, Indus Vy., ca. 5000 m; 4169: S Rumtse, NW Taglang La, 4660 m. H

Myosotis asiatica Schischk. et Serg. (*M. alpestris* ssp. *asiatica* Vest. ex Hult.); 2316: SE Matayan, Dras Vy., 3450 m, (Nr. 5); 2317: N Sanmodangsa, Suru Vy., 4190 m, (Nr. 86); 2449: Pensi La, 4410 m, (Nr. 167). H

Table 2: - Community dominated by *Artemisia brevifolia* +

Table 3: - Grassland dominated by *Carex melanantha* IV 1

- *Bistorta affinis* community-group II-III +

- Community of *Koeleria cristata* and *Stipa pennata* ssp. *kirghisorum* 1-2

Table 6: - Community of *Nepeta discolor* / *Festuca kashmiriana* I +

- Community dominated by *Kobresia schoenoides* +

Pseudomertensia echioides (Benth.) Riedl; 2324: Sanmodangsa, Suru Vy., 4040 m, (Nr. 82); 2323: Vy. E of Kartse, Suru Vy., 4160 m, (Nr. 67). H, (G)

Table 2: - Community dominated by *Artemisia brevifolia* +

Table 3: - *Bistorta affinis* community-group II-IV +-1

- *Artemisia brevifolia*-*Cicer microphyllum* community II +

- Community-group of *Festuca kashmiriana* and *Poa suruana* +

Pseudomertensia echioides cf. var. *lahulensis* (Brand) Kazmi; *Klim. & Srut.* (30. 8. 89): about 1 km SW of Darcha, Lahul, 3650 m. H

Rochelia laxa J.M. Johnston; 2312: SE Matayan, Dras Vy., 3450 m, (Nr. 5). T

Table 3: - Relevé in community of *Koeleria cristata* and *Stipa pennata* ssp. *kirghisorum* 1

Brassicaceae (Cruciferae)

Aphragmus oxycarpus (Hook. f. et Th.) Jafri; 2621: Pensi La, 4360 m, (Nr. 161); 2620: Stok Phu, Indus Vy., 4740 m, (Nr. 127); 3066: Nimaling, Markha Vy., 4860 m, (Nr. 201); 4058: N Taglang La, 5200 m, (Nr. 239); 5040b: E below Khardung La, 5100 m, (Nr. 287). *Klim. & Srut.* (2. 9. 89): Baralacha La, Lahul, 4640 m. H

Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group +-II +-1

- Community dominated by *Kobresia schoenoides* +

- Relevé within higher *Kobresia* grassland +

Arabis tenuirostris Schulz; 2183: N Sanmodangsa, Suru Vy., 4050 m, (Nr. 93). H

Table 3: - Relevé in grassland dominated by *Kobresia schoenoides* and *Agrostis vinealis* +

Arabis tibetica Hook. f. et Th. (*A. quinqueloba* O.E. Schulz); 2181: W Sanku, Suru Vy., 3680 m, (Nr. 64); 2197: S above Mulbekh, 3740 m, (Nr. 10); 2636: Stok Phu, Indus Vy., 4550 m, (Nr. 120). *Bill. & Léon. 6836*: above Hemis, 4000 m. *Klim. & Srut.* (13. 9. 89): Zoji La, 3330 m. T

Table 2: - Community of *Koeleria cristata* / *Tanacetum artemisioides* II +

- Community dominated by *Artemisia brevifolia* II +

- Community of *Artemisia brevifolia* / *Tanacetum fruticosum* +

- Community of *Artemisia wellbyi* / *Lindelofia anchusoides* I 1

- *Stachys tibetica* community I +

- Relevé within the transitional zone to the alpine belt on Fotu La +

Table 3: - Community-group of *Festuca kashmiriana* and *Poa suruana* +-IV +-1

- *Artemisia brevifolia*-*Cicer microphyllum* community I +

Table 4: - *Aconogonon tortuosum*-*Nepeta glutinosa* community IV +-2

- Community-group of *Elymus canaliculatus* and *Potentilla bifurca* IV +-1

- Community-group of *Elymus canaliculatus* and *Thermopsis inflata* / *Biebersteinia odora* IV +-2

- Community-group of *Krascheninnikovia pungens* / *Ptilotrichum canescens* I +

- Community-group of *Potentilla bifurca* / *Artemisia gmelinii* +

Table 5: - *Caragana* community of the regions of Taglang La – Rupshu and Kanda La, Matho Phu II +

Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group +-II +-2

- Community of *Nepeta discolor* / *Festuca kashmiriana* I +

Brassica rapa L. ssp. *campestris* (L.) Clapham; 6009: Nang, Indus Vy., 3850 m, cultivated. T

Capsella bursa-pastoris (L.) Medik.; 3067: N above Leh, ca. 3650 m. T

Chorispora sabulosa Camb.; 2182: S Namika La, 3950 m, (Nr. 17). *Klim. & Srut.* (10. 9. 89): Fotu La, 3920 m. H

Table 2: - Community of *Koeleria cristata* / *Tanacetum artemisioides* +

- Relevé within a transitional zone to the alpine belt on Fotu La +

Christolea crassifolia Camb.; 2184: NW Fotu La, 4200 m, (Nr. 26); 2630: N Kanda La, ca. 4600 m. G, (H)

Table 1: - Communities of the higher subalpine desert I +-2

Table 2: - Community dominated by *Artemisia brevifolia* I +

- Community of *Artemisia brevifolia* / *Tanacetum fruticosum* +

- *Stachys tibetica* community I 1

Table 4: - *Stipa glareosa*-*Krascheninnikovia pungens* community IV +-1

- Community-group of *Krascheninnikovia pungens* / *Ptilotrichum canescens* III r-2
 - Community of *Stipa breviflora* / *Tanacetum fruticosum* II +
 - Community-group of *Elymus canaliculatus* and *Potentilla bifurca* +
- Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group II r
- Christolea himalayensis*** (Camb.)Jafri; 3068: S Kongmaru La, Nimaling., 5100 m, (Nr. 212). H
- Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group +
- Christolea parkeri*** (O.E.Schulz)Jafri; 4152: Taglang La, 5310 m. H
- Christolea stewartii*** (T.Anders.)Jafri; 5041: Lachalung La, ca. 5070 m. H
- Table 5: - *Caragana* community of the region: Taglang La – Rupshu I +
- Descurainia sophia*** (L.)Webb et Berth.; 3074: N above Leh, ca. 3600 m. T
- Table 1: - Relevé from a stand with additional water supply +
- Dilophia salsa*** Thoms.; 4195: S above Runtse, N Taglang La, 4650 m. H,(T)
- Dontostemon glandulosus*** (Kar.et Kir.)O.E.Schulz; 2637: Stok Phu, Indus Vy., 4650 m. T
- Draba altaica*** (C.A.Mey.)Bunge; 2185: W Matho Phu, Indus Vy., 4930 m, (Nr. 52); 2635: Stok Phu, Indus Vy., 4700 m, (Nr. 126); 2634: Pensi La, 4360 m, (Nr. 161); 3069: Nimaling, Markha Vy., 4860 m, (Nr. 201); 4053: Taglang La, 5320 m; 5040a: SE Khardung La, 5100 m, (Nr. 287). *Klim. & Srut.* (1. 9. 89): Bhaga River-Vy., Lahul, 4520 m. H,Ch
- Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group II-V +-2
- Community dominated by *Kobresia schoenoides* +
 - Relevé within *Carex* grassland (Rupshu) +
- Draba cachemirica*** Gandager; 2191: W Sanku, Suru Vy., 4150 m; 2189: Valley E of Kartse, 4060 m, (Nr. 69); 2190: E Dras, 3540 m, (Nr. 8). *Klim. & Srut.* (2. 9. 89): Baralacha La, Lahul, 4640 m. Ch
- Table 2: - Community dominated by *Artemisia brevifolia* III r-2
- Relevé of the *Koeleria cristata* community r
- Table 3: - *Bistorta affinis* community-group V +-3
- Community-group of *Festuca kashmiriana* and *Poa suruana* I +-2
 - *Artemisia brevifolia*-*Cicer microphyllum* community I +
 - Transitional zone between subalpine steppe and *Bistorta affinis* community +
- Draba glomerata*** Royle; 4049: Debring, Rupshu, 5050 m, (Nr. 261); 4054: NE Taglang La, 5220 m, (Nr. 238); 4056: W Taglang La, ca. 4900 m; 6010: S above Tsoltak towards Chang La, 5150 m. Ch
- Table 5: - *Caragana* community of the region: Taglang La – Rupshu I r
- Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group II-IV +-2
- Draba lanceolata*** Royle; 2186: Matho Phu, Indus Vy., 4930 m, (Nr. 52); 4050: Debring, Rupshu, 4820 m, (Nr. 252); 4051: at the same place *Draba* cf. *lanceolata* x *altaica* ! 6011: S above Karzok Phu, Rupshu, 4750 m, (Nr. 338). H,(Ch)
- Table 5: - *Caragana* community of the region: Taglang La – Rupshu II +
- Relevé in the catchment area of Tso Moriri +
- Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group +-II +-1
- Draba lasiophylla*** Royle; *Klim. & Srut.* (1. 9. 89): Bhaga Riv.-Vy., Lahul, 4160 m, 4520 m; (30. 8. 89): SW Darcha, Lahul, 3650 m. H,(Ch)
- Draba oreades*** Schrenk et C.A.Mey.; 2631: Stok Phu, Indus Vy., 4740 m, (Nr. 127); 4052: NE Taglang La, 5250 m, (Nr. 237); 4055: NE Taglang La, 5220 m, (Nr. 238). Ch
- Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group I-II +-2
- Draba setosa*** Royle; 2632: Pensi La, 4380 m, (Nr. 162). Ch,(H)
- Table 6: - Community dominated by *Kobresia schoenoides* II +-1
- Community of *Nepeta discolor* / *Festuca kashmiriana* II +-1
- Draba stenocarpa*** Hook.f. et Th.; 2188: S Matayan, Dras Vy., 3550 m, (Nr. 4). *Klim. & Srut.* (1. 9. 89): Bhaga Riv.-Vy., Lahul, 4160 m. T
- Table 3: - Community of *Koeleria cristata* and *Stipa pennata* ssp. *kirghisorum* +-1
- *Bistorta affinis* community-group IV r-+
- Draba tibetica*** Hook.f. et Th. var. *tibetica* Jafri; 2187: Valley E of Kartse, Suru Vy., 4140 m, (Nr. 68); 2633: SW Tungri, Zanskar, 4120 m, (Nr. 156). Ch
- Table 2: - Community dominated by *Artemisia brevifolia* I +

Table 3: - *Bistorta affinis* community-group I-IV +2

Erysimum melicentae Dunn; 2192: SE Matayan, Dras Vy., 3370 m, (Nr. 6). H

Table 3: - Grassland of *Koeleria cristata* and *Stipa pennata* ssp. *kirghisorum* +

Hedinia tibetica (Th.)Ostenf.; 3065: N Kongmaru La, Indus Vy., ca. 4700 m; 4059: N Taglang La, 4900 m. H

Hymenolobus procumbens (L.)Nutt.; 6012: Umla, Indus Vy., 3850 m. T

Lepidium apetalum Willd.; 2193: Matho Phu, Indus Vy., 4380 m, (Nr. 39); 2629: N Kanda La, 4520 m; 2628: N Leh, 3550 m; 3071: N above Leh, 3600 m; 5042: N Tso Kar, Rupshu, 4600 m. H,T

Table 2: - *Stachys tibetica* community II +

Table 4: - Community-group of *Elymus canaliculatus* and *Potentilla bifurca* II +

Lepidium latifolium L.; 2626: Phiyang, Indus Vy., 3400 m; 2625: Mulbekh, ca. 3200 m; 2624: W Leh, 3400 m. Bill. & Léon. 6812: Khalsi, Indus Vy., 2950 m. Ch

Table 1: - Desert communities of the higher subalpine belt r

Matthiola flavida Boiss. (*M. odoratissima* Hook.f.et Anders.); 2195: S Mulbekh, 3570 m, (Nr. 12); 2194: E of Khalsi, Indus Vy., 3160 m, (Nr. 28); 3072: Leh, ca. 3670 m. Bill. & Léon. 6819: above Hemis, 3950 m. H,(G)

Table 1: - Communities of the lower and higher subalpine desert III r-2

- *Artemisia* steppe of a transitional zone to the alpine belt II +

- Relevé in a depression I

- Relevé from a stand with additional water supply I

Table 2: - Community of *Artemisia brevifolia* / *Tanacetum fruticosum* III r-+

- Community of *Koeleria cristata* / *Tanacetum artemisioides* II +-1

- *Stachys tibetica* community I +

Parrya nudicaulis (L.)Regel; 2623: Stok La, Indus Vy., 4800 m; (9. 8. 87): N of Kongmaru La very common from about 4400 m upw.! Bill. & Léon. 6869: above Sabu, Indus Vy., 4800 m. H

Pegaeophyton scapiflorum (Hook.f.et Th.)Marq. et Shaw; 2619: Stok Phu, Indus Vy., 4600 m. H

Ptilotrichum canescens (DC.)C.A.Mey.; 3070: S Tchatchutse, Markha Vy., 4530 m, (Nr. 198); 4057: Rumtse, N Taglang La, 4450 m, (Nr. 229); 6013: ca. 6 km W of Pangong Tso, 4250 m. H,G

Table 1: - Relevé within a transitional zone to the alpine belt in SE I

Table 4: - Community-group of *Krascheninnikovia pungens* / *Ptilotrichum canescens* IV +-2

- *Stipa purpurea*-*Carex moorcroftii* community V +-2

- *Stipa glareosa*-*Krascheninnikovia pungens* community III r-2

- Community-group of *Potentilla bifurca* / *Artemisia gmelinii* II +-1

- Community of *Stipa breviflora* / *Tanacetum fruticosum* II +

Table 5: - *Artemisia minor*-*Potentilla pamirica* community II +

Sisymbrium brassiciforme C.A.Mey.; 2196: Alchi Brok, Indus Vy., 4160 m, (Nr. 34); 2627: Dzongkhul, Zanskar, 3830 m, (Nr. 152); 3073: S Yangtang, Indus Vy., 3550 m. Klim. & Srut. (4. 9. 89): S Upshi, 3390 m. H,T

Table 1: - Community of the higher subalpine desert r

Table 2: - Community of *Artemisia wellbyi* / *Lindelofia anhusoides* I r-+

- *Stachys tibetica* community III +-1

Table 3: - *Artemisia brevifolia*-*Cicer microphyllum* community I r

Table 4: - *Aconogonon tortuosum*-*Nepeta glutinosa* community III +-3

Tauscheria lasiocarpa Fisch. ex DC.; 2622: Tungri, Zanskar, 3600 m. T

Torularia cf. *humilis* (C.A.Mey.)O.E.Schulz; 5043: N Khardung La, Shyok Vy., 4510 m, (Nr. 283). T,H

Table 4: - Community-group of *Potentilla bifurca* / *Artemisia gmelinii* I +

Campanulaceae

Campanula aristata Wall.in Roxb.; 3139: Yangtang, Indus Vy., 3600 m; 5031: Khardung, Shyok Vy. 3800 m. H

Campanula pallida Wall.var. *tibetica* (Hook.f.et Th.)Hara; 2060: Alchi Brok, Indus Vy., 4030 m (Nr. 31); 2409: Wakha Vy., ca. 3600 m; 2410: N Leh, 3550 m; 3140: Yangtang, N of Indus Vy., 3600 m; (30. 7. 79): area of Leh very common on stone-walls! Bill. & Léon. 6795: E of Namika La, 3600 m. Klim. & Srut. (12. 9. 89): E of Dras, 2960 m H

Table 1: - Community of the higher subalpine desert r

Table 2: - *Stachys tibetica* community +-II +-1

- Relevé of the *Koeleria cristata* community r

Codonopsis clematidea (Schrenk)Clarke; 2061: S Matayan, Dras Vy., 3420 m; 2408: Mulbekh, ca. 3150 m. H

Cyananthus lobatus Wall.; 4004: S Rohtang Pass, Himachal Pradesh, ca. 3600 m. H

Capparidaceae

Capparis spinosa L.; 2059: W Khalsi, Indus Vy., 3190 m, (Nr. 22); (29. 7. 92): above Phiyang, ca. 3400 m; area of Leh up to about 3600 m. Bill. & Léon. 6801: Lamayuru, 3600 m. Ch

Table 1: - Desert community of the lower subalpine belt I +

Caprifoliaceae

Lonicera asperifolia (Dcne.) Hook. f. et Th.; 2056: Sanmodangsa, Suru Vy., 3950 m, (Nr. 81); 2400: Tungri, Zaskar, ca. 3800 m. Klim. & Srut. (1. 9. 89): Valley of Bhaga River, Lahul, 4160 m. NP

Table 2: - Community dominated by *Artemisia brevifolia* I +

- *Stachys tibetica* community I r

- Community of *Artemisia wellbyi* / *Lindelofia anchusoides* +

Table 3: - *Artemisia brevifolia*-*Cicer microphyllum* community II +

- *Bistorta affinis* community-group I r

Lonicera caerulea L. var. *altaica* Sweet ex Dippel; 2403: Wakha Vy., ca. 3600 m. NP

Lonicera heterophylla Decne.; 2057: Alchi Brok, Indus Vy., 4460 m, (Nr. 37). NP

Table 4: - *Aconogonon tortuosum*-*Nepeta glutinosa* community +

Lonicera microphylla Willd. ex Roem. et Schult.; 2402: Wakha Vy., 3600 m; 3141: Shingo, Markha Vy., 3780 m. NP

Lonicera semenovii Regel; Bill. & Léon. 6861: Tirdik N Sabu, 4800 m. Ch

Lonicera spinosa (Dcne.) Walp.; 2058: Matho Phu, Indus Vy., 4410 m, (Nr. 42); 5032: S above Hemis, 3870 m; 6015: ca. 8 km E of Tsoltak (N of Chang La), 4760 m; (29. 7. 92): above Phiyang ca. 3500 m. Bill. & Léon. 6799: E of Namika La, 3600 m. NP, Ch

Table 2: - *Stachys tibetica* community I r

Table 4: - *Aconogonon tortuosum*-*Nepeta glutinosa* community I 2

Table 5: - *Caragana* community of the region: Kanda La and Matho Phu I 1

Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group II 2

Caryophyllaceae

Arenaria bryophylla Fern.; 3059: Nimaling, Markha Vy., 4750 m. In most of the highest vegetation relevés, up to 5170 m. Ch

Table 4: - *Stipa purpurea*-*Carex moorcroftii* community I r

Table 5: - *Artemisia minor*-*Potentilla pamirica* community V +-2

- *Caragana* community of the region: Taglang La – Rupshu I r

- Relevé in the *Caragana* community at the high valley of Nimaling +

Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group II-IV +-2

Arenaria griffithii Boiss.; 2161: SW Dras, 3450 m, (Nr. 1); 2160: Yasghun E of Dras, 3520 m, (Nr. 7). Ch, (G)

Table 2: - *Kochia cristata* community and community of *Koeleria cristata* / *Tanacetum artemisioides* III +-2

- Community dominated by *Artemisia brevifolia* II +-1

- Community devoid of or with only sporadic *Artemisia brevifolia* II +-1

Table 3: - *Bistorta affinis* community-group II-III +

- Transitional zone between subalpine steppe and *Bistorta affinis* community 2

Arenaria leptoclados (Reichb.) Guss. Klim. & Srut. (13. 9. 89): S Zoji La, 3330 m. T

Cerastium cerastioides (L.) Britt. (*C. trigynum* Vill.); 2162: Vy. E of Kartse, Suru Vy., 4160 m, (Nr. 67); 2687: Pensi La, 4360 m, (Nr. 161); 5039: SE Khardung La, 5100 m, (Nr. 287). Klim. & Srut. (2. 9. 89): Baralacha La, 4640 m. Ch

Table 3: - *Bistorta affinis* community-group V +-1

Table 6: - Community dominated by *Kobresia schoenoides* V +-2

- Community of *Nepeta discolor* / *Festuca kashmiriana* II +

- *Poa attenuata*-*Potentilla pamirica* community-group III +

Cerastium fontanum Baumg. s.l.; 4007: N above Leh, ca. 3540 m. Ch, H

Cerastium glomeratum Thuill.; Klim. & Srut. (31. 8. 89): Bhaga Riv. Vy., Lahul, 3250 m. H, T

Cerastium pusillum Ser.; 2688: Stok Phu, Indus Vy., 4740 m; 3055: Nimaling, Markha Vy., 4870 m, (Nr. 202). Ch

Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group II +-1

Cerastium thomsonii Hook.f.in FBI; *Klim. & Srut.*(13. 9. 89): Zoji La, 3330 m. Ch

Dianthus anatolicus Boiss.; 2164: SW Dras, 3450 m, (Nr. 1); 2163: W Sanmodangsa, Suru Vy., 4340 m, (Nr. 89).
Bill. & Léon. 6782: near Kargil, 2950 m. Ch

Table 2: - Community of *Koeleria cristata* / *Tanacetum artemisioides* V +-2
- Community dominated by *Artemisia brevifolia* V +-2
- Community devoid of or with only sporadic *Artemisia brevifolia* IV 1
- Community of *Artemisia wellbyi* / *Lindelofia anchusoides* II +
- - Relevé of a rock debris community devoid of or with only sporadic *Stachys tibetica* +
- - Relevé in the low subalpine steppe-desert (W Ladakh) 1

Table 3: - *Bistorta affinis* community-group V +-1
- Transitional zone between subalpine steppe and *Bistorta affinis* community +
- Community of *Koeleria cristata* and *Stipa pennata* ssp.kirghisorum 1
- Community-group of *Festuca kashmiriana* and *Poa suruana* III +-2
- *Artemisia brevifolia*-*Cicer microphyllum* community I +
- - Relevé in grassland dominated by *Carex pseudofetida* r

Table 6: - Community of *Nepeta discolor* / *Festuca kashmiriana* I 1

Gypsophila cerastioides D.Don; 4005: S Rohtang Pass, Him. Prad., ca. 3600 m. H

Gypsophila sedifolia Kurz; 2165: S Mulbekh, 3300 m, (Nr. 19); 4006: N Leh, 3780 m, (Nr. 219). *Klim. & Srut.*
(12. 9. 89): E Dras, 2960 m. Ch

Table 1: - Relevé within a transitional zone to the alpine belt N of Likir +
- Relevé in a depression +

Table 2: - Community of *Artemisia brevifolia* / *Tanacetum fruticosum* II r-+
- Community of *Koeleria cristata* / *Tanacetum artemisioides* I +
- Community dominated by *Artemisia brevifolia* I r

Lepyrodiclis holosteoides (C.A.Mey.)Fenzl; 2682: NW Tungri, Zanskar, 3600 m; 2680: Wakha Valley, 3600 m;
3056: Ang, Indus Vy., ca. 3600 m; 6014: W of Karzok, Tso Moriri, 4560 m. T

Minuartia kashmirica (Edgew.)Mattf. (*M. lineata* (C.A.Mey.)Bornm.); 2166: Fotu La, 4220 m, (Nr. 24); 2685: Back-ground of Wakha Vy., about 3850 m. Ch

Table 1: - Communities of the higher subalpine desert r
- - Relevé within a transitional zone to the alpine belt N of Likir +

Table 2: - Community dominated by *Artemisia brevifolia* +
- - Relevés within the transitional zone to the alpine belt on Fotu La +/3

Table 4: - *Aconogonon tortuosum*-*Nepeta glutinosa* community IV +-1

Sagina saginoides (L.)Karst. (*S. procumbens* auct.); 2167: N Sanmodangsa, Suru Vy., 4050 m, (Nr. 93). H,Ch

Table 3: - Relevé in grassland dominated by *Kobresia schoenoides* and *Agrostis vinealis* 1

Silene conoidea L. ; *Bill. & Léon.* 6775: Dras, 3100 m. T

Silene gonosperma (Rupr.)Bocquet ssp. *himalayensis* (Rohrb.)Bocquet; 2173: Yasghun, Dras Vy., 3540 m, (Nr.9);
2172: Matho Phu, Indus Vy., 4930 m, (Nr. 52); 3058: Nimaling, Markha Vy., 4860 m, (Nr. 201); 4008: SE Taglang La, 5050 m, (Nr. 261); 4009: NE Taglang La, 5250 m, (Nr. 237); 4010: Debring, Rupshu, 4840 m, (Nr. 259). H

Table 3: - Transitional zone between subalpine steppe and *Bistorta affinis* community +

Table 5: - *Caragana* community of the region: Taglang La – Rupshu I +

Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group II r-1
- Community of *Nepeta discolor* / *Festuca kashmiriana* I +
- - Relevé within higher *Kobresia* grassland +

Silene indica Roxb.ex Otth in DC.; *Klim. & Srut.*(1. 9. 89): Vy. of Bhaga Riv., Lahul, 4160 m; (30. 8. 89): 1 km SW of Darcha, Lahul, 3650 m. H

Silene moorcroftiana Wall.; 2169: S Mulbekh, 3500 m; 2168: S Fotu La, 4200 m, (Nr. 23). Ch,(G)

Table 1: - Communities of the higher subalpine desert +
- - Relevé in a depression +

Table 2: - in most of the subalpine steppe communities +-V +-2

Table 3: - *Bistorta affinis* community-group II +

Table 4: - *Aconogonon tortuosum*-*Nepeta glutinosa* community II +-1
- Community-group of *Elymus canaliculatus* and *Potentilla bifurca* II +-1
- Community-group of *Potentilla bifurca* / *Artemisia gmelinii* II +-1
- - Relevé in a succession stage of *Artemisia wellbyi* r

Table 5: - *Caragana* community of the region of Kanda La and Matho Phu I 1

Table 6: - Community of *Nepeta discolor* / *Festuca kashmiriana* II +

Silene tenuis Willd.; 2171: W Sanmodangsa, Suru Vy., 4190 m, (Nr. 87); 2170: Valley E of Kartse, Suru Vy., 4140 m, (Nr. 68); 2684: Wakha Vy., ca. 3750 m. *Klim. & Srut.* (1. 9. 89): Vy. of Bhaga River, Lahul, 4160 m; (30. 8. 89): 1 km SW of Darcha, Lahul, 3650 m. H₁(G)

Table 3: - *Bistorta affinis* community-group II +
- Community-group of *Festuca kashmiriana* and *Poa suruana* +

Table 6: - Community of *Nepeta discolor* / *Festuca kashmiriana* I +

Silene vulgaris (Moench)Garcke s.l.(*S. inflata* Sm.); *H. Hartmann* (26. 7. 79): E of Kanda La, 4540 m, (Nr. 141). H,Ch

Table 5: - *Caragana* community of the region of Matho Phu and Kanda La I +

Stellaria montioides (Edgew. & Hook.f.)S.A.Ghazanfar; 2178: Alchi Brok, Indus Vy., 4460 m, (Nr. 37); 2176: W of Matho Phu, Indus Vy., 4900 m, (Nr. 51). H₁(G)

Table 4: - *Aconogonon tortuosum*-*Nepeta glutinosa* community +

Stellaria* cf. *montioides Ghaz.; 2177: Sanmodangsa, Suru Vy., 4050 m, (Nr. 93).

Table 3: - Relevé in grassland dominated by *Kobresia schoenoides* and *Agrostis vinealis* +

Table 5: - *Caragana* community of the region of Taglang La – Rupshu I 2

Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group III +-2

- - Relevé within *Carex* grassland (Rupshu) 1

Stellaria* cf. *persica Boiss.; 2174: W Matho Phu, Indus Vy., 4930 m, (Nr. 52); 2175: Matho Phu, 4550 m, (Nr. 40); 2683: Valley of Stok Phu, Indus Vy., 4750 m, (Nr. 129). H₁(G)

Table 5: - *Artemisia minor*-*Potentilla pamirica* community IV 1

- *Caragana* community of the region: Matho Phu and Kanda La II +

Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group II-III r-1

- - Relevé within higher *Kobresia* grassland 2

Stellaria tibetica Kurz; 2681: Background of Wakha Vy., ca. 3750 m. H,Ch

Thylacospermum caespitosum (Camb.)Schischk.; 2179: Matho Phu, Indus Vy., 4930 m, (Nr. 52); 3060: Nimaling, Markha Vy., 4750 m. *Bill. & Léon. 6871*: Tirdik N Sabu, Indus Vy., 4800 m. Ch

Table 5: - *Artemisia minor*-*Potentilla pamirica* community IV +-1

- *Caragana* community of the region of Taglang La – Rupshu I +

Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group I-V r-1

- - Incomplete species list (10) from Lachalung La (Rupshu)

Chenopodiaceae

Axyris hybrida L.; 2122: Sanmodangsa, Suru Vy., 3940 m, (Nr.84); 4016: Vy. of Debring, Rupshu, 4820 m, (Nr. 252); 5066: S Khardung La, 4440 m. T

Table 2: - Community of *Artemisia brevifolia* / *Tanacetum fruticosum* I r

Table 3: - Community-group of *Festuca kashmiriana* and *Poa suruana* II +-1

- *Artemisia brevifolia*-*Cicer microphyllum* community I +

Table 4: - Community-group of *Krascheninnikovia pungens* / *Ptilotrichum canescens* I +

Table 5: - *Caragana* community of the region: Taglang La – Rupshu II 1

Bassia fiedleri Aellen; 2123: E Khalsi, Indus Vy., 3160 m, (Nr. 28); 4019: NW Sabu, Indus Vy., 3650 m; 5033: Panamik, Nubra Vy., ca. 3230 m; 6077: ca. 5 km W of Pangong Tso, 4300 m. T

Table 1: - Communities of the lower as well as the higher subalpine desert +

Bassia stellaris (Moq.)Bornm.; 2741: between Leh and Saspul; 2740: Tungri, Zaskar, 3650 m; 3062: W Sabu, Indus Vy., 3400 m; 4020: E of Sabu, 3760 m. T

Table 1: - Communities of the higher subalpine desert +

Chenopodium botrys L.; 2125: N Panikhar, Suru Vy., 3380 m, (Nr. 76). T

Table 1: - Communities of the higher subalpine desert I +-1

- Relevé in a depression +

- Relevé from a stand with additional water supply r

Table 2: - Community of *Artemisia wellbyi* / *Lindelofia anchusoides* II r-+

- *Stachys tibetica* community I 1

- - Relevé from a rock debris community devoid of or with only sporadic *Stachys tibetica* 1/1

Chenopodium foliosum (Moench)Asch.; 2121: S Matho, Indus Vy., 3800 m, (Nr. 55). *Klim. & Srut.* (13. 9. 89): Zoji La, 3330 m; (10. 9. 89): Fotu La, 3890 m. T

Table 2: - *Stachys tibetica* community on rock debris I +

Chenopodium karoï (Murr) Aellen; 2124: Alchi Brok, Indus Vy., 4110 m, (Nr. 33); 2737: Mulbekh, ca. 3200 m.
Klim. & Srut. (9. 9. 89): Khalsi, 2900 m; (13. 9. 89): ca. 15 km E Dras, 3330 m. T

Table 1: - Communities of the higher subalpine desert +

- - Relevé in a depression +

- - Relevé from a stand with additional water supply +

Table 4: - *Aconogonon tortuosum*-*Nepeta glutinosa* community II +

Chenopodium cf. *karoï*

Table 2: - *Stachys tibetica* community I +

Table 5: - *Caragana* community of the region of Matho Phu and Kanda La I +

Chenopodium nepalense Colla; 4015: NW Leh, ca. 3620 m. T

Chenopodium cf. *novopokrovskyanum* (Aellen) Uotila; 4013: NW Sabu, ca. 3680 m. T

Chenopodium pamaricum Iljin; 4014: Debring, Rupshu, 4820 m, (Nr. 252); 5037: N Tso Kar, Rupshu, 4600 m. T

Table 4: - Community-group of *Krascheninnikovia pungens* / *Ptilotrichum canescens* I +-1

- *Stipa purpurea*-*Carex moorcroftii* community I 1

Table 5: - *Caragana* community of the region: Taglang La – Rupshu II +-2

Table 6: - List (12) from the catchment area of Tso Moriri

Corispermum tibeticum Iljin; 6083: ca. 6 km W of Pangong Tso, 4250 m, (Nr. 314); 6084: ca. 5 km W of Pangong Tso, 4300 m.
Klim. & Srut. (8. 9. 89): Saspul, Indus Vy., 3320 m. T

Table 4: - *Stipa glareosa*-*Krascheninnikovia pungens* community I 2

Halogeton arachnoideus Moq.; 6079(a): ca. 4 km E of Muglib, 4200 m. T

Table 4: - *Stipa glareosa*-*Krascheninnikovia pungens* community II +

Halogeton glomeratus C.A.Mey.; 2734: N Leh, 3680 m; 4011: S Leh, 3380 m, (Nr. 215); 4012: Ladakh Konka, Indus Vy., 3550 m, (Nr. 277); 5034: above Panamik, Nubra Vy., 3230 m; 6079(b): 4 km E of Muglib, 4200 m. T

Table 1: - Communities of the higher subalpine desert II r-2

- - Relevé in a depression +

- - Relevé from a stand with additional water supply +

Haloxylon thomsonii Bunge; 2126: N Khalsi, Indus Vy., 3210 m, (Nr. 21); 2735: Leh, 3680 m, (Nr. 115); 3064: NE Leh, 3670 m; 4017: S Stok, Indus Vy., 3700 m, (Nr. 247). Ch

Table 1: - Communities of the lower and higher subalpine desert II-IV r-2

Kochia prostrata (L.) Schrad.; 2742: SW Tungri, Zaskar, 3760 m, (Nr. 153); 2128: Namika La, 3800 m, (Nr. 14); 2127: N Panikhar, Nubra Vy., 3350 m, (Nr. 72); 3061: W Yangtang, Indus Vy., 3700 m, (Nr. 188). *Klim. & Srut.* (10. 9. 89): Fotu La, 3890 m. Ch

Table 1: - Communities of the higher subalpine desert r

Table 2: - Community dominated by *Artemisia brevifolia* I-II +-1

- Community of *Artemisia wellbyi* / *Lindelofia anchusoides* II r-1

Table 3: - *Artemisia brevifolia*-*Cicer microphyllum* community IV +-1

Kochia scoparia Schrad. ssp. *indica* (Wight) Aellen; 2739: S Leh, ca. 3450 m. T

Krascheninnikovia pungens (Pazij) Podlech. (*Eurotia ceratoides* p.p. (L.) C.A.Mey.). Most of the Ladakh

Krascheninnikovia refers to *K. pungens* (Pazij) Podlech. 2129: Mulbekh, 3570 m, (Nr. 12);

2738: N Kanda La, 4540 m, (Nr. 140). *Klim. & Srut.* (10. 9. 89): Fotu La, 3890 m. Ch, (NP)

Table 1: - Community of the higher subalpine desert II r-2

- - Relevé in a depression +

- - Relevé from a stand with additional water supply 2

Table 2: - Community of *Koeleria cristata* / *Tanacetum artemisioides* I +-1

- Community dominated by *Artemisia brevifolia* I +

- Community of *Artemisia brevifolia* / *Tanacetum fruticosum* I 1

- *Stachys tibetica* community I +

- - Relevé within a transitional zone to the alpine belt on Fotu La r

Table 4: - within most of the steppe and semidesert communities of the alpine belt III-IV r-3

Table 5: - in all communities listed in table 5 I-V +-3

Salsola Jacquemontii Moq.; 5036: N Tso Kar, Rupshu, 4600 m; 6080: ca. 1 km W above Kiagar Tso, Rupshu, 4720 m, (Nr. 335). T

Table 4: - Community-group of *Krascheninnikovia pungens* / *Ptilotrichum canescens* I r-1

- *Stipa glareosa*-*Krascheninnikovia pungens* community I +

- *Stipa purpurea*-*Carex moorcroftii* community I +
- Salsola tragus*** L.; 4018: N Leh, ca. 3620 m; 2736: S Leh, 3430 m; 3063: N Leh, 3600 m; 5038: Nie, Indus Vy. (N Basgo), 3800 m. T
- Table 1: - Communities of the higher subalpine desert +
- - Relevé from a stand with additional water supply 1
- Table 4: - *Stipa glareosa*-*Krascheninnikovia pungens* community II r+ +
- Suaeda olufsenii*** Pauls.; 5035: N Tso Kar, Rupshu, 4600 m; 6081: Muglib, 4120 m; 6082: NW littoral zone of Pangong Tso, 4250 m. T
- Table 6: - Incomplete species list (12) from the catchment area of Tso Moriri
- Convolvulaceae**
- Convolvulus arvensis*** L.; 2419: N Leh, ca. 3600 m; 3168: above Leh, ca. 3600 m. G,H
- Table 2: - Relevés of a rock debris community devoid of or with only sporadic *Stachys tibetica* +/-
- Crassulaceae**
- Hylotelephium ewersii*** (Led.)H.Ohba (*Sedum ewersii* Ledeb.); 2200: N Sanmodangsa, Suru Vy., 4050 m, (Nr. 92); 2646: below Dzongkhul Gompa, Zaskar, 3800 m. *Klim. & Srut.* (13. 9. 89): Zoji La, 3330 m. Ch
- Table 3: - Community-group of *Festuca kashmiriana* and *Poa suruana* I +
- Rhodiola quadrifida*** Fisch.et C.Mey.; 2643: Zoji La, ca. 3700 m. *Bill. & Léon.* 6864: Tirdik, N Sabu, Indus Vy., 4800 m. Ch
- Rhodiola tibetica*** (Hook.f.et Th.)Fu; 2198: Matho Phu, Indus Vy., 4410 m, (Nr. 42); 2645: S Tungri, Zaskar, 4000 m, (Nr. 157); 2644: N Kanda La, 4550 m, (Nr. 133); 4047: S Rumtse, Vy. to Taglang La, 4700 m; 4048: N of Taglang La, 4900 m; 6016: ca. 11 km E of Tsoltak, 4600 m. H,(Ch)
- Table 2: - Community dominated by *Artemisia brevifolia* I r+ +
- Table 3: - *Bistorta affinis* community II +
- *Artemisia brevifolia*-*Cicer microphyllum* community II +
- Table 5: - *Artemisia minor*-*Potentilla pamirica* community II +
- *Caragana versicolor* community of the region: Taglang La – Rupshu, Kanda La and Matho Phu I-III +
- Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group II +2
- - Relevé within higher *Kobresia* grassland +
- - Species list (10) from Lachalung La (Rupshu)
- Rhodiola wallichiana*** (Hook.f.)S.H.Fu (*Sedum crassipes* (Hook.f.et Th.)); 2199: E Sanku, Suru Vy., 4140 m, (Nr. 68); 2647: Pensi La, 4360 m, (Nr. 161). *Bill. & Léon.* 6867: Tirdik, N Sabu, 4800 m. *Klim. & Srut.* (1. 9. 89): Vy. of Bhaga Riv., 4160 m and 4520 m. H,Ch
- Table 6: - Community dominated by *Kobresia schoenoides* V +2
- Community of *Nepeta discolor* / *Festuca kashmiriana* IV +2
- *Poa attenuata*-*Potentilla pamirica* community-group IV +2
- Rosularia alpestris*** (Kar.et Kir.)Boriss. (*Sempervivella acuminata* (Decne.)Berger); 2201: S Matayan, Dras Vy., 3550 m, (Nr. 4); 2202: S above Yasghun, Dras Vy., 3520 m, (Nr. 7); 2203: SW Dras, 3450 m, (Nr. 1); 2642: Pensi La, 4360 m, (Nr. 163). *Klim. & Srut.* (30. 8. 89): SW Darcha, Lahul, 3650 m and (31. 8. 89): Vy. of Bhaga River, Lahul, 3170 m. Ch
- Table 2: - Community of *Koeleria cristata* / *Tanacetum artemisioides* III +-1
- Community dominated by *Artemisia brevifolia* II +
- Table 3: - *Bistorta affinis* community-group IV-V +
- *Artemisia brevifolia*-*Cicer microphyllum* community I +
- Community of *Koeleria cristata* and *Stipa pennata* ssp.kirghisorum 1/+
- Transitional zone between subalpine steppe and *Bistorta affinis* community 1/+
- - Relevé of the community-group of *Festuca kashmiriana* and *Poa suruana* 1
- Table 6: - Community dominated by *Kobresia schoenoides* II +-1
- Community of *Nepeta discolor* / *Festuca kashmiriana* III +-1
- Cupressaceae**
- Juniperus communis*** L.ssp. *alpina* (Neilr.)Celak. (*J. communis* var. *saxatilis* Pall.); 2051: Sanmodangsa, Suru Vy., 3900 m. *Klim. & Srut.* (30. 8. 89): SW Darcha, Lahul, 3650 m. Ch,(NP)
- Juniperus semiglobosa*** Regel.; 2697: end of Wakha Vy. SE Mulbekh, 3450 m; 2696: upper part of Wakha Vy., 3850 m; 3002: Hemis Shukpachan, 3600 m. NP, P

Cuscutaceae

Cuscuta cf. *capitata* Roxb.; 2052: S Mulbekh, 3310 m, (Nr. 13); 3167: Ang, Indus Vy., 3550 m, (Nr. 194); 2420: Tungri, Zanskar, 3850 m, (Nr. 159); 2053: W Sanku, Suru Vy., 4050 m, (Nr. 62). T

Table 1: - Communities of the higher subalpine desert +

Table 2: - Community devoid of or with only sporadic *Artemisia brevifolia* I +
- - Relevé in the low subalpine steppe-desert 1

Cuscuta planiflora Tenore (*C. europea* auct. non L.); 2421: end of Wakha Vy. SE Mulbekh, 3440 m, (Nr. 145); 5044: Nie N Basgo, Indus Vy., 3820 m. T

Table 2: - Community of *Koeleria cristata* / *Tanacetum artemisioides* I +
- Community of *Artemisia wellbyi* / *Lindelofia anchusoides* +

Cyperaceae

Blasmus compressus (L.) Panzer ex Link; 2608: Mulbekh, ca. 3150 m; 2607: middle of Wakha Vy. SE Mulbekh, 3600 m; 3003: N Leh, ca. 3650 m; 6018: Muglib, N of Chang La, 4120 m; 6019: W Karzok, Tso Moriri, ca. 4560 m. G

Table 6: - Incomplete species list (11) from the catchment area of Tso Moriri

Carex borii Nelmes fo. *lutea* RRS; 4065: NW Taglang La, 5250 m, (Nr. 237). H,G

Table 6: - *Poa attenuata*-*Potentilla pamiica* community-group I 1-4
- - Relevé within higher *Kobresia* grassland 2

Carex melanantha C.A.Mey.; 2377: Sanmodangsa, Suru Vy., 4190 m, (Nr. 86); 2590: Pensi La, 4340 m, (Nr. 174). Klim. & Srut. (1. 9. 89): Vy. of Bhaga River, Lahul, 4160 m. H,G

Table 3: - Grassland dominated by *Kobresia melanantha* V 5
- - Relevé within community-group of *Festuca kashmiriana* and *Poa suruana* 1

Carex microglochin Wahlenb.; 4126: S Rumtse, N Taglang La, 4500 m; 5045: N Tso Kar, Rupshu, 4600 m. H,G

Carex montis-everestii Kükenth.; 4067: Debring, Rupshu, 4830 m, (Nr. 268). H

Table 6: - Relevé within *Carex* grassland (Rupshu) 2

Carex moorcroftii Falc.ex Boott; 2376: N Sanmodangsa, Suru Vy., 4170 m, (Nr. 94); 2589: Pensi La, 4360 m, (Nr. 163); 6021: Kiagar La, Rupshu, 4800 m; 6022: S Tsoltak, N of Chang La, 5150 m. H,G

Table 3: - Community-group of *Festuca kashmiriana* and *Poa suruana* V +-5
- *Artemisia brevifolia*-*Cicer microphyllum* community I +

Table 4: - *Stipa purpurea*-*Carex moorcroftii* community IV 2-3
- Community-group of *Potentilla bifurca* / *Artemisia gmelinii* I 1-2

Table 5: - *Caragana* community of the region: Taglang La – Rupshu I 1

Table 6: - *Poa attenuata*-*Potentilla pamiica* community-group I-III +-2
- Community of *Nepeta discolor* / *Festuca kashmiriana* I 2
- Community dominated by *Kobresia schoenoides* I +
- - Relevé within higher *Kobresia* grassland +

Carex nivalis Boott var. *nivalis*; 2591: Pensi La, 4400 m. Klim. & Srut. (1. 9. 89): Vy. of Bhaga River, Lahul, 4160 m. H,(G)

Carex orbicularis Boott; 2592: middle of Wakha Vy. E Mulbekh, 3600 m; 6020: ca. 11 km E Tsoltak, N of Chang La, ca. 4600 m. H,G

Carex plectobasis V.Krecz.; 2374: S Matayan, Dras Vy., 3550 m, (Nr. 4). H

Table 3: - Relevé in community of *Koeleria cristata* and *Stipa pennata* ssp. *kirghisorum* 1

Carex pseudofoetida Kük.; 2371: Matho Phu, Indus Vy., 4900 m, (Nr. 51); 2596: S Stok, Indus Vy., 4000 m; 2595: Vy. of Stok Phu, 4700 m, (Nr. 126); 2594: S Kanda La, 4880 m, (Nr. 135); 2593: Pensi La, 4350 m, (Nr. 169); 3004: S Kongmaru La, 5100 m, (Nr. 212); 3005: Nimaling, Markha Vy., 4750 m; 3006: Nimaling, 5170 m, (Nr. 204); 2597: middle of Wakha Vy. SE Mulbekh, ca. 3600 m; 2373: W Sanku, Suru Vy., 3880 m, (Nr. 61). H,G

Table 2: - Community dominated by *Artemisia brevifolia* I +-2
- Community of *Artemisia wellbyi* / *Lindelofia anchusoides* II 1-2
- - Relevé of the *Koeleria cristata* community I
- - Relevé within a transitional zone to the alpine belt on Fotu La 1
- - Relevé of a rock debris community devoid of or with only sporadic *Stachys tibetica* 1

Table 3: - *Bistorta affinis* community-group II +
- Community-group of *Festuca kashmiriana* and *Poa suruana* I 1
- - Relevé in grassland dominated by *Carex pseudofoetida* 4

- - Relevé in grassland dominated by *Kobresia royleana* and *Leontopodium leontopodinum* 1
- Table 4: - *Aconogonon tortuosum*-*Nepeta glutinosa* community +
- Table 5: - *Caragana* community of the region of Matho Phu and Kanda La I +
- Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group II-V +-4
- Community dominated by *Kobresia schoenoides* II +-1
- Community of *Nepeta discolor* / *Festuca kashmiriana* I +
- Carex sagaensis*** Y.C.Yang; 5046: N Tso Kar, Rupshu, ca. 4600 m. H,(G)
- Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group I 1-2
- - Relevé in moist grassland at a plain 3
- - Relevé within higher *Kobresia* grassland 2
- - Relevé within *Carex* grassland (Rupshu) 3
- - Incomplete species list (11) from the catchment area of Tso Moriri
- Carex stenocarpa*** Turcz.ex Krecz. (*C. tristis* M.Bieb. var. *asiatica* Litv.); 2368: Vy. E of Kartse, Suru Vy., 4140 m, (Nr. 68). H
- Table 3: - *Bistorta affinis* community-group II 2
- Carex stenophylla*** Wahlenb.; 2372: W Panikhar, Suru Vy., 3600 m, (Nr. 77); 2370: Matho Phu, Indus Vy., 4310 m, (Nr. 53); 2598: Pensi La, 4380 m, (Nr. 176); 2599: SW Tungri, Zanskar, 3870 m, (Nr. 154); 4060: NE Spituk, 3380 m, (Nr. 215); 4061: N Leh, ca. 3620 m; 4062: betw. Debring and Tso Kar, Rupshu, 4680 m, (Nr. 254); 4066: Taglang La, 5310 m; 2369: Yasghun, Dras Vy., 3520 m, (Nr. 7); 2375: S Namika La, 3950 m, (Nr. 17). H,G
- Table 1: - Communities of the higher subalpine desert r 2
- *Artemisia* steppe of a transitional zone to the alpine belt II 1
- - Relevé in a depression +
- - Relevé from a stand with additional water supply 1
- Table 2: - Community dominated by *Artemisia brevifolia* III +-2
- Community devoid of or with only sporadic *Artemisia brevifolia* IV 2
- Community of *Artemisia brevifolia* / *Tanacetum fruticosum* II +-2
- Community of *Koeleria cristata* / *Tanacetum artemisioides* I +
- Community of *Artemisia wellbyi* / *Lindelofia anchusoides* +
- Table 3: - *Bistorta affinis* community-group I +
- Table 4: - Community of *Stipa breviflora* / *Tanacetum fruticosum* I 1
- Community-group of *Potentilla bifurca* / *Artemisia gmelinii* I 1
- Community-group of *Elymus canaliculatus* and *Potentilla bifurca* +
- Community-group of *Krascheninnikovia pungens* / *Ptilotrichum canescens* +
- Table 6: - Community of *Nepeta discolor* / *Festuca kashmiriana* I +
- - Species list (10) from Lachalung La (Rupshu)
- Eleocharis quinqueflora*** (Hartm.)O.Schw.; 2609: middle of Wakha Vy. E Mulbekh, ca. 3600 m. H
- Eleocharis uniglumis*** (Link)Schultes; 4070: below Shey Gompa, Indus Vy., 3300 m. G
- Isolepis setacea*** (L.)R.Br.; 5047: S above Matho, Indus Vy., 3700 m. T,H
- Kobresia capillifolia*** (Decne.)Clarke; 2601: Stok Phu, Indus Vy., 4750 m, (Nr. 129); 2600: Pensi La, 4360 m, (Nr.170); 2367: Vy. E of Kartse, Suru Vy., 4160 m, (Nr. 67); 4069: N Taglang La, 4950 m, (Nr. 231). Klim. & Srut. (30. 8. 89): SW Darcha, Lahul, 3650 m. H
- Table 3: - *Bistorta affinis* community-group IV 1-2
- Table 5: - *Artemisia minor*-*Potentilla pamirica* community II 2
- *Caragana* community of the region of Taglang La – Rupshu I 1
- Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group II 1-2
- Community dominated by *Kobresia schoenoides* +
- Kobresia karakorumensis*** Dickoré sp.nov.; 2603: S Stok Phu, Indus Vy., 4750 m, (Nr. 129); 2602: Pensi La, 4360 m, (Nr. 161). H
- Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group II 1-2
- Community dominated by *Kobresia schoenoides* +
- Kobresia* cf. *kashgarica*** Dickoré; 6023: W Karzok, Tso Moriri, 4560 m. H
- Table 6: - Incomplete species list (11) from the catchment area of Tso Moriri
- Kobresia nitens*** Clarke; Klim. & Srut. (1. 9. 89): Vy. of Bhaga Riv., Lahul, 4520 m. H
- Kobresia pygmaea*** Clarke; 6017: S Karzok Phu, Tso Moriri, 4700 m. H
- Table 6: - Incomplete species list (11) from the catchment area of Tso Moriri

Kobresia royleana (Nees) Boeck.; 2364: S Matho Phu, Indus Vy., 4450 m, (Nr. 43); 2365: W Sanku, Suru Vy., 3880 m, (Nr. 61); 3007: Nimaling, Markha Vy., 4860 m, (Nr. 201); 4068: NW Leh, ca. 3610 m. H

Table 3: - *Bistorta affinis* community-group II +

- - Relevés in grassland dominated by *Kobresia royleana* and *Leontopodium leontopodium* +/-

Table 4: - Community-group of *Potentilla bifurca* / *Artemisia gmelinii* +

Table 5: - *Caragana* community of the region of Matho Phu and Kanda La III +/-1

Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group +/-III +/-3

- - Relevé within higher *Kobresia* grassland 3

- - Relevé within *Carex* grassland (Rupshu) 2

- - Species lists (11, 12) from the catchment area of Tso Moriri

Kobresia schoenoides (C.A.Mey.) Steudel (*K. pamiroalaica* Ivan.); 2366: W Sanmodangsa, Suru Vy., 4190 m, (Nr. 86); 2606: N Kanda La, 4890 m, (Nr. 136); 2605: Pensi La, 4360 m, (Nr. 161); 2604: near Dzongkhul Gompa, Zanskar, 3800 m; 3008: S above Nimaling, Markha Vy., 5170 m, (Nr. 204). H

Table 3: - Grassland dominated by *Carex melanantha* IV 1-2

- - Community-group of *Festuca kashmiriana* and *Poa suruana* II +

- - Relevé in grassland dominated by *Kobresia schoenoides* and *Agrostis vinealis* 3

Table 6: - in all communities of the alpine belt II-V +/-5

Schoenoplectus tabernaemontani (Gmelin) Palla; 4071: below Shey Gompa, Indus Vy., 3300 m. G

Elaeagnaceae

Hippophae rhamnoides L. ssp. *turkestanica* Rousi; 3169: Yangtang, Indus Vy., 3650 m. NP

Ephedraceae

Ephedra gerardiana Wall. ex Stapf; 2049: E Kartse, Suru Vy., 4060 m, (Nr. 69); 2044: W Panikhar, Suru Vy., 3580 m, (Nr. 79); 2045: S Matayan, Dras Vy., 3550 m, (Nr. 4); 2048: W Sanmodangsa, Suru Vy., 3900 m; 5048: N Khardung La, ca. 4750 m; 2046: Yasghun, Dras Vy., 3520 m, (Nr. 7); 2047: SW Panikhar, Suru Vy., 3810 m, (Nr. 105); 6024: ca. 9 km E Tsoltak, N of Chang La, 4780 m. Ch

Table 2: - Community dominated by *Artemisia brevifolia* I-IV +/-2

- - Community of *Koeleria cristata* / *Tanacetum artemisioides* II r-1

- - Community devoid of or with only sporadic *Artemisia brevifolia* I +

- - Community of *Artemisia wellbyi* / *Lindelofia achusoides* I +

- - Relevé of the *Koeleria cristata* community +

Table 3: - *Bistorta affinis* community-group II +/-1

- - *Artemisia brevifolia*-*Cicer microphyllum* community II r+/-

- - Community-group of *Festuca kashmiriana* and *Poa suruana* I 1

- - Relevés in grassland of *Koeleria cristata* and *Stipa pennata* ssp. *kirghisorum* 2/r

Table 4: - Community-group of *Elymus canaliculatus* and *Potentilla bifurca* I-IV r-2

- - Community-group of *Elymus canaliculatus* and *Thermopsis inflata* / *Biebersteinia odora* I +

- - Community-group of *Potentilla bifurca* / *Artemisia gmelinii* +

- - *Aconogonon tortuosum*-*Nepeta glutinosa* community +

Table 6: - Community of *Nepeta discolor* / *Festuca kashmiriana* II 1-3

- - *Poa attenuata*-*Potentilla pamirica* community-group I r

Ephedra intermedia Schrenk et Mey.; 2700: SW Tungri, Zanskar, 3650 m; 2699: middle of Wakha Vy., ca. 3600 m; 3009: Ritzong Gompa, Indus Vy., 3450 m; (13. 7. 87): between Lamayuru and Riv. Indus common; (29. 7. 92): Phiyang, Indus Vy., 3400-3600 m. Klim. & Srut. (5. 9. 89): Upshi, Indus Vy., 3370 m. Ch, NP

Table 1: - Relevé from a stand with additional water supply +

Ephedra regeliana Florin; 2050: S Matho, Indus Vy., 3790 m, (Nr. 56); 2701: N Leh, 3610 m, (Nr. 113); 3010: N Leh, ca. 3650 m; 3011: Ang, Indus Vy., 3550 m. Ch, G

Table 1: - Communities of the subalpine desert II r-2

- - Relevé in a depression 2

- - Relevé from a stand with additional water supply 2

- - Relevé within a transitional zone to the alpine belt N of Likir +

Table 2: - Community of *Artemisia brevifolia* / *Tanacetum fruticosum* III +/-1

- - *Stachys tibetica* community I +

Equisetaceae

Equisetum ramosissimum Desf.; 2020: Sanmodangsa, Suru Vy., 3980 m, (Nr. 91); 4072: SW Choglamsar, Indus Vy. ca. 3200 m. G

Table 3: - Community-group of *Festuca kashmiriana* and *Poa suruana* I +

Euphorbiaceae

Euphorbia thomsoniana Boiss.; 2043: SW Dras, 3430 m, (Nr. 2). H,(G)

Table 2: - Community of *Koeleria cristata* / *Tanacetum artemisioides* I +

Table 3: - Community of *Koeleria cristata* and *Stipa pennata* ssp. *kirghisorum* +

Euphorbia tibetica Boiss.; 2042: E Khalsi, Indus Vy., 3160 m, (Nr. 27); 2041: S Mulbekh, 3740 m, (Nr. 10); 2040: Mulbekh, 3250 m, (Nr. 18); 2764: NE Leh, 3600 m, (Nr. 112); 3075: Ang, Indus Vy., 3550 m, (Nr. 193).
Klim. & Srut. (12. 9. 89): E of Dras, near Kargil, 2960 m. H,G

Table 1: - in all communities of the subalpine desert II-III r-1

Table 2: - Community of *Artemisia brevifolia* / *Tanacetum fruticosum* IV +-1

- *Stachys tibetica* community III +

- Community of *Koeleria cristata* / *Tanacetum artemisioides* I +

- - Relevé of a rock debris community devoid of or with only sporadic *Stachys tibetica* I

- - Relevé in the low subalpine steppe-desert (W Ladakh) I

Table 4: - Within most of the alpine steppes and semidesert communities I-V r-2

Fabaceae (Papilionaceae)

Astragalus confertus Benth.; 2825: Vy. of Stok Phu, Indus Vy., 4700 m, (Nr. 126); 3093: Nimaling, Markha Vy., 5150 m, (Nr. 205); 4137: Taglang La, 5310 m; 6037: S Tsoltak, N Chang La, 5150 m, (Nr. 326). H,(Ch)

Table 5: - *Artemisia minor*-*Potentilla pamirica* community II 1

Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group II-III +-3

- - Relevé within higher *Kobresia* grassland +

- - Relevé within *Carex* grassland (Rupshu) I

- - Species list (11) from the catchment area of Tso Moriri

Astragalus densiflorus Kar. et Kir.; 2823: Wakha Vy. SE of Mulbekh, 3750 m; 3092: between Shang and Kongmaru La, ca. 4100 m. H

Astragalus falconeri Bunge; 2211: N Panikhar, Suru Vy., 3370 m, (Nr. 73). H

Table 2: - Community of *Artemisia wellbyi* / *Lindelofia anchusoides* II +-1

- *Stachys tibetica* community II +

- Community dominated by *Artemisia brevifolia* +

Astragalus heydei Baker; 6039: Kiagar La, Rupshu, 4800 m, (Nr. 331). H

Table 4: - *Stipa purpurea*-*Carex moorcroftii* community I r

Astragalus himalayanus Klotzsch; *Klim. & Srut.* (9. 9. 89): Khalsi, Indus Vy., 2900 m. H

Astragalus hoffmeisteri (Klotzsch) Ali; 2826: background of Wakha Vy., SE Mulbekh, 3800 m; 5063: S Khardung La, 4100 m, (Nr. 294); 6036: N Umla, Indus Vy., 4000 m, (Nr. 311). *Bill. & Léon.* 6810: Khalsi, Indus Vy., 2950 m; 6891: Rizong River, Indus Vy., 3150 m. H

Table 2: - Community of *Artemisia brevifolia* / *Tanacetum fruticosum* I +

Astragalus macropterus DC.; 2213: S Namika La, 3800 m, (Nr. 14). H

Table 2: - Community dominated by *Artemisia brevifolia* I +

Astragalus maxwellii Royle (*A. ciliolatus* Benth.); Aerea of Lamayuru, ca. 3400 m; leg. *W. Strasser* end of June, 1979, det. *H. Hartmann.* H

Astragalus munroi Benth. ex Bunge; 2208: Alchi Brok, Indus Vy., 4000 m; 2207: E Mulbekh, ca. 3300 m; 2827: Wakha Vy., SE Mulbekh, 3650 m; 5060: above Gangles, N Leh, 3930 m, (Nr. 297). *Klim. & Srut.* (12. 9. 89): E Dras, 2960 m. H

Table 1: - Communities of the higher subalpine desert r

Table 2: - Community of *Artemisia brevifolia* / *Tanacetum fruticosum* +

Table 4: - *Aconogonon tortuosum*-*Nepeta glutinosa* community I r

Astragalus nivalis Kar. et Kir. (*A. thomsonianus* Benth.); 2209: S Fotu La, 4220 m, (Nr. 24); 2828: Wakha Vy. SE of Mulbekh, 3800 m. *Bill. & Léon.* 6797: E of Namika La, 3600 m. H

Table 2: - Community dominated by *Artemisia brevifolia* I +

- - Relevé within a transitional zone to the alpine belt on Fotu La I

Astragalus oplites Benth.; 2218: W Sanku, Suru Vy., 3320 m, (Nr. 57); 2216: S Namika La, 3800 m, (Nr. 14); 2217: SW Dras, 3430 m, (Nr. 2); 2832: background of Wakha Vy., ca. 3800 m; 2831: S Stok Phu, Indus Vy., 4640 m, (Nr. 123); 2830: N Leh, 3600 m; 2829: Tungri, Zaskar, 3640 m, (Nr. 149). Ch

Table 1: - Communities of the higher subalpine desert +

- *Artemisia* steppe of a transitional zone to the alpine belt II +

- - Relevé from a stand with additional water supply r
- Table 2: - in most of the subalpine steppe communities +-V r-3
- Table 3: - Relevé in *Koeleria cristata-Stipa pennata* ssp.kirghisorum community 1
 - Relevé in transitional zone between subalpine steppe and *Bistorta affinis* community +
- Table 4: - Community-group of *Elymus canaliculatus* and *Potentilla bifurca* I-III +-1
 - Community-group of *Potentilla bifurca* / *Artemisia gmelinii* IV +-2
 - Community-group of *Elymus canaliculatus* and *Thermopsis inflata* / *Biebersteinia odora* I 1
- Astragalus peduncularis*** Royle ex Benth.; 2212: N Panikhar, Suru Vy., 3510 m, (Nr. 75). H
- Table 2: - Community dominated by *Artemisia brevifolia* I +
 - Community of *Artemisia wellbyi* / *Lindelofia anchlussoides* +
- Astragalus rhizanthus*** Royle ex Benth.; 2219: SE Matayan, Dras Vy., 3450 m, (Nr. 5); 2221: W Panikhar, Suru Vy., 3480 m, (Nr. 80); 2833: Pensi La, 4380 m, (Nr. 172); 2220: Sanmodangsa, Suru Vy., 4340 m, (Nr. 89); 5061: cf.: S Khardung La, 4530 m, (Nr. 290). Klim. & Srut. (31. 8. 89): Valley of Bhaga Riv., Lahul, 3250 m. H,(Ch)
- Table 2: - Community dominated by *Artemisia brevifolia* II +
 - Community devoid of or with only sporadic *Artemisia brevifolia* I +
- Table 3: - Community-group of *Festuca kashmiriana* and *Poa suruana* V +-2
 - *Bistorta affinis* community-group II +
 - *Artemisia brevifolia-Cicer microphyllum* community I +
 - Community of *Koeleria cristata* and *Stipa pennata* ssp.kirghisorum +/2
 - - Relevé in grassland dominated by *Kobresia schoenoides* and *Agrostis vinealis* +
- Table 6: - Community of *Nepeta discolor* / *Festuca kashmiriana* II 1-2
- Astragalus strictus*** Grah.ex Benth.; 2834: N Leh, ca. 3550 m; 3098: Tchatchutse, Markha Vy., ca. 4380 m; 2824: S Kanda La, 4880 m, (Nr. 135); 4141: Phiyang, Indus Vy., 3600 m; 5064: N Khardung La, 4550 m, (Nr. 284). H
- Table 4: - Community-group of *Potentilla bifurca* / *Artemisia gmelinii* II +-1
- Table 6: - *Poa attenuata-Potentilla pamiirica* community-group I 1
- Astragalus subuliformis*** DC.; 2214: Mulbekh, 3250 m, (Nr. 18); 2215: S Mulbekh, 3310 m, (Nr. 13). H,(G)
- Table 2: - Community of *Koeleria cristata* / *Tanacetum artemisioides* II +
 - Community dominated by *Artemisia brevifolia* I +
 - - Relevé in the low subalpine steppe-desert (W Ladakh) +
- Astragalus tecti-mundi*** Freyn (*A. frigidus* auct., non (L.)A.Gray); 2210: W Sanmodangsa, Suru Vy., 4190 m, (Nr. 86). According to Dickoré & Nüsser (2000) close to *A. frigidus*, but a more robust plant with larger flowers! G
- Table 3: - Grassland dominated by *Carex melanantha* V +-1
 - *Artemisia brevifolia-Cicer microphyllum* community I +
 - Community-group of *Festuca kashmiriana* and *Poa suruana* +
- Astragalus tibetanus*** Benth.ex Bunge; 2835: background of Wakha Vy., 3800 m. H,(G)
- Astragalus tribulifolius*** Benth.ex Bunge; 6038: between Muglib and Pangong Tso, 4250 m. H
- Caragana versicolor*** Benth.; 2233: S Matho Phu, Indus Vy., 4410 m, (Nr. 42); 2234: Fotu La, 4200 m; 2849: N Kanda La, 4530 m; 3094: Nimaling, Markha Vy., 4800 m, (Nr. 206); 4143: NW Taglang La, 4890 m, (Nr.232). Ch
- Table 4: - Community-group of *Elymus canaliculatus* and *Potentilla bifurca* I-III r-+
 - Community-group of *Krascheninnikovia pungens* / *Ptilotrichum canescens* II r-2
 - Community of *Stipa breviflora* / *Tanacetum fruticosum* II r
- Table 5: - Dominating within all *Caragana* communities V 3-5
- Chesneya cuneata*** (Benth.)Ali (*Calophaca cuneata* (Benth.)Kom.); 2231: Mulbekh, 3310 m, (Nr. 13). H
- Table 1: - Communities of the lower and higher subalpine desert II r-1
 - - Relevé in a depression +
- Table 2: - Community of *Koeleria cristata* / *Tanacetum artemisioides* I +-1
 - Community of *Artemisia brevifolia* / *Tanacetum fruticosum* I +-1
 - *Stachys tibetica* community I +
 - - Relevé in the low subalpine steppe-desert (W Ladakh) 1
- Cicer microphyllum*** Benth. (*C. songaricum* sens.Baker, non Steph.); 2232: Sanmodangsa, Suru Vy., 3950 m, (Nr.81); 2846: Tungri, Zanskar, 3680 m, (Nr. 150); 3095: between Kongmaru La and Shang, Indus Vy., 4200 m. Moh. Deen (11. 8. 92): Sapi, W-Ladakh. Klim. & Srut. (13. 9. 89): E Dras, 3330 m. H,(G)
- Table 1: - Communities of the higher subalpine desert +
 - - Relevé within a transitional zone to the alpine belt N of Likir +
- Table 2: - Community of *Artemisia wellbyi* / *Lindelofia anchlussoides* III r-3

- Community of *Artemisia brevifolia* / *Tanacetum fruticosum* II r-1
- *Stachys tibetica* community +-I r
- Table 3: - *Artemisia brevifolia*-*Cicer microphyllum* community V +-2
- Community-group of *Festuca kashmiriana* and *Poa suruana* IV 1-2
- Table 4: - Community-group of *Potentilla bifurca* / *Artemisia gmelinii* +
- Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group I +
- Medicago falcata*** L.; 2838: Mulbekh, ca. 3150 m; 2230: Mulbekh, 3350 m. H
- Table 2: - Relevé in the low subalpine steppe-desert (W Ladakh) r
- Medicago lupulina*** L.; 4150: Phiyang, Indus Vy., ca. 3600 m. T,H
- Medicago sativa*** L.; 4144: NW Leh, ca. 3630 m. Table 1: - Relevé from a stand with additional water supply r
- Medicago x varia*** Martyn; 2837: Tungri, Zanskar, 3600 m; 4146: NW Leh, 3620 m; 4147: NW above Leh, same stand as 4146, also 4148 and 4149 ! H
- Melilotus officinalis*** (L.)Pall.; 2836: Tungri, Zanskar, 3600 m; 4145: Sankar near Leh, 3620 m. T,H
- Oxytropis cachemiriana*** Camb.; 2226: W Sanmodangsa, Suru Vy., 4000 m; 2227: S Mulbekh, 3740 m, (Nr. 10); 2816: Pensi La, 4360 m, (Nr. 161). Bill. & Léon. 6791: Namika La, 3700. H
- Table 2: - Community of *Koeleria cristata* / *Tanacetum artemisioides* II +
- Community dominated by *Artemisia brevifolia* II 1
- - Relevé within a transitional zone to the alpine belt on Fotu La +
- - Relevé in the low subalpine steppe-desert (W Ladakh) +
- Oxytropis chiliophylla*** Royle ex Benth.; 3099: Nimaling, Markha Vy., 5170 m, (Nr. 204). H
- Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group I +
- Oxytropis densa*** Benth.ex Bge.; 3100: Nimaling, Markha Vy., 4750 m, (Nr. 211). H,(Ch)
- Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group III +-1
- Oxytropis humifusa*** Kar.et Kir.; 2229: SW Matho Phu, Indus Vy., 4470 m, (Nr. 44); 2228: W Matho Phu, 4800 m, (Nr. 50); 2820: Pensi La, 4460 m, (Nr. 166); 2819: S Kanda La, 4880 m, (Nr. 135); 2818: Stok Phu, Indus Vy., 4610 m, (Nr. 125); 3102: Nimaling, Markha Vy., 4860 m, (Nr. 201). H
- Table 3: - *Bistorta affinis* community-group IV +
- Table 4: - Community-group of *Elymus canaliculatus* and *Potentilla bifurca* I-IV r-3
- Community-group of *Elymus canaliculatus* and *Thermopsis inflata* / *Biebersteinia odora* II +-1
- Community-group of *Potentilla bifurca* / *Artemisia gmelinii* +
- Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group III-V +-3
- Community of *Nepeta discolor* / *Festuca kashmiriana* III +-2
- Community dominated by *Kobresia schoenoides* +
- Oxytropis hypoglottoides*** (Baker)Ali; 2817: Mulbekh, ca. 3200 m; 3097: Tchatchutse, Markha Vy., 4400 m; 4139: S Runtse, N Taglang La, ca. 4500 m; 4140: Phiyang, Indus Vy., 3600 m. H
- Table 6: - Relevé in moist grassland at a plain 4
- Oxytropis lapponica*** (Wahlenb.)Gay; 2222: W Sanku, Suru Vy., 3880 m, (Nr. 61). H
- Table 3: - *Bistorta affinis* community-group I-IV +-1
- - Relevé in grassland dominated by *Kobresia royleana* and *Leontopodium leontopodium* 1/1
- Oxytropis microphylla*** (Pallas)DC.; 2225: E Matho Phu, Indus Vy., 4310 m, (Nr. 53); 2821: N Kanda La, 4600 m. Bill. & Léon. 6876: Tirdik N Sabu, 4500 m. H
- Table 1: - Communities of the higher subalpine desert r
- - Relevé within a transitional zone to the alpine belt in SE 2
- - Relevé within a transitional zone to the alpine belt N of Likir +
- - Relevé in a depression +
- Table 2: - Community of *Artemisia brevifolia* / *Tanacetum fruticosum* II r-2
- Table 4: - in most of the alpine steppe and semidesert communities II-V r-2
- Table 5: - *Caragana* community of the region: Taglang La – Rupshu I +
- Oxytropis mollis*** Royle (*O. thomsonii* Benth ex Bge.); 2822: Wakha Vy. SE Mulbekh, ca. 3750 m; 2224: SE Matayan, Dras Vy., 3450 m, (Nr. 5); 2223: SW Dras, 3450 m, (Nr. 1). Klim. & Srut. (10. 9. 89): Fotu La, 3920 m. H,(G)
- Table 2: - Community of *Koeleria cristata* / *Tanacetum artemisioides* IV +-1
- Community dominated by *Artemisia brevifolia* IV +-1
- - Relevés within a transitional zone to the alpine belt on Fotu La +/-
- Table 3: - *Bistorta affinis* community-group I-II 1

- Community of *Koeleria cristata* and *Stipa pennata* ssp. *kirghisorum* +-1
- Relevés of the transitional zone between subalpine steppe and *Bistorta affinis* community 1/+

Table 4: - *Aconogonon tortuosum*-*Nepeta glutinosa* community +-III +-1

Oxytropis tatarica Camb.ex Bge.; 3101: S Kongmaru La, 5100 m, (Nr. 212); 4138: Taglang La, 5310 m; 4142: Debring, Rupshu, 4820 m, (Nr. 252); 5062: Norbo, More Plain, 4840 m, (Nr. 307); 6040: NW above Karzok, Tso Moriri 4700 m, (Nr. 330); 6041: S above Tsoltak, N ChangLa, 5150 m, (Nr. 326); 6042: W above Karzok, Tso Moriri, 4680 m, (Nr. 329). *Klim. & Srut.* (10. 9. 89): Fotu La, 3890 m. H

Table 4: - Community-group of *Krascheninnikovia pungens* / *Ptilotrichum canescens* II-V +-2

- *Stipa purpurea*-*Carex moorcroftii* community III r+
- *Stipa glareosa*-*Krascheninnikovia pungens* community II +-1
- Community-group of *Potentilla bifurca* / *Artemisia gmelinii* +

Table 5: - *Artemisia minor*-*Potentilla pamiirica* community IV 1

- *Caragana* community of the region: Taglang La – Rupshu IV +-1

Table 6: - *Poa attenuata*-*Potentilla pamiirica* community-group +-V +-2

- Relevé within higher *Kobresia* grassland 1
- Incomplete species list (10) from Lachalung La (Rupshu)

Thermopsis inflata Camb.; 2235: Alchi Brok, Indus Vy., 4110 m, (Nr. 33); 2848: Stok Phu, Indus Vy., 4550 m, (Nr. 120); 2847: S Stok Phu, Indus Vy., 4710 m, (Nr. 124). H,G

Table 4: - *Aconogonon tortuosum*-*Nepeta glutinosa* community IV +-3

- Community-group of *Elymus canaliculatus* and *Thermopsis inflata* / *Biebersteinia odora* IV 1-3
- Community-group of *Elymus canaliculatus* and *Potentilla bifurca* +

Filicinae

Botrychium lunaria (L.)Sw.; 2022: N Sanmodangsa, Suru Vy., 4050 m, (Nr. 93). G

Table 3: - Relevé in grassland dominated by *Kobresia schoenoides* and *Agrostis vinealis* r

Cystopteris dickieana R.Sim.; 2021: Sanmodangsa, 4050 m, (Nr. 93); 2692: Pensi La, 4370 m, (Nr. 178); 5049: S Hemis, Indus Vy., 3870 m. *Klim. & Srut.* (13. 9. 89): Zoji La, 3330 m. H

Table 3: - Relevé in grassland dominated by *Kobresia schoenoides* and *Agrostis vinealis* +

Table 6: - Community of *Nepeta discolor* / *Festuca kashmiriana* I +

- *Poa attenuata*-*Potentilla pamiirica* community-group I r

Fumariaceae

Corydalis adiantifolia Hook.f.et Th.; 2180: 8 km E of Kargil, Dras Vy., ca. 3000 m. H

Corydalis flabellata Edgew.; 2640: N below Rumbak, ca. 3700 m; 3078: NW Yangtang, Indus Vy., 3750 m, (Nr. 190). *Bill. & Léon.* 6789: Namika La, 3700 m. *Klim. & Srut.* (4. 9. 89): S Upshi, Indus Vy., 3390 m. H

Table 1: - Communities of the lower and higher subalpine desert +-I +-1

Corydalis govaniana Wall.var. *govaniiana* Jafri; 3079: cf.: Tchatchutse, Markha Vy., 4380 m. H

Corydalis cf. *govaniiana* Wall.var. *malukiana* Jafri; 2638: Pensi La, 4360 m. H

Corydalis meifolia Wall.; 4075: Rohtang Pass, Lahul, ca. 4000 m. H

Corydalis stricta Steph.ex Fisch.; 4076: N Taglang La, ca. 4700 m; seen at different places nord and soud of the pass up to 5000 m! H

Corydalis tibetica Hook.f.et Th.; *Bill. & Léon.* 6880: Tirdik N Sabu, Indus Vy., 4200 m. H

Hypecoum leptocarpum Hook.f.et Th.; 6032: Kiagar La, Rupshu, 4800 m, (Nr. 331). T

Table 4: - *Stipa purpurea*-*Carex moorcroftii* community I +

Table 6: - Incomplete species list (12) from the catchment area of Tso Moriri

Gentianaceae

Gentiana algida Pall.var. *nubigena* (Edgew.)Kusnez.; 4090: N Taglang La, 5200 m, (Nr. 239). H

Table 6: - *Poa attenuata*-*Potentilla pamiirica* community-group +

- Relevé within higher *Kobresia* grassland +

Gentiana azurea Bunge; 4086: Debring, Rupshu, ca. 4900 m; 4087: Debring, 4830 m, (Nr. 268); 4085: N Taglang La, 5200 m, (Nr. 239). T

Table 6: - Relevé within higher *Kobresia* grassland r

- Relevé within *Carex* grassland (Rupshu) 2

Gentiana borealis Bunge; 2308: S Yasghun, Dras Vy., 3540 m, (Nr. 9). *Klim. & Srut.* (30. 8. 89): SW Darcha, Lahul, 3650 m; (1. 9. 89): Vy. of Bhaga Riv., Lahul, 4160 m. T

Table 3: - Relevés within the transitional zone between subalpine steppe and *Bistorta affinis* community +/-

Gentiana carinata Griseb.; 2307: W Sanku, Suru Vy., 3880 m, (Nr. 61); 2423: Pensi La, 4340 m. T

Table 3: - Relevé in grassland dominated by *Kobresia royleana* and *Leontopodium leontopodium* +

Table 6: - Community dominated by *Kobresia schoenoides* +

Gentiana clarkei Kusnez.; 2425: Pensi La, 4350 m. T

Gentiana falcata Turcz. (*Comastoma falcatum* (Turcz.) Toyokuni); 2309: E Kartse, Suru Vy., 3830 m, (Nr. 66); 4084: NW Sankar, above Leh, ca. 3600 m; 4089: SE Taglang La, 5050 m, (Nr. 261); 6025: Camp W Karzok, Tso Moriri, 4560 m. *Klim. & Srut.* (2. 9. 89): Baralacha La, Lahul, 4640 m; (1. 9. 89): Vy. of Bhaga Riv., Lahul, 4520 m. T

Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group +

- - Incomplete species lists (11, 12) from the catchment area of Tso Moriri

Gentiana leucomelaena Maxim.; 2306: W Sanku, Suru Vy., 3880 m, (Nr. 61); 2427: Mulbekh, ca. 3150 m; 2426: S Stok, Indus Vy., ca. 3650 m; 3170: Ang, Indus Vy., 3600 m; 4080: S Runtse, N Taglang La, 4500 m, (Nr. 245). T

Table 3: - Relevés in grassland dominated by *Kobresia royleana* and *Leontopodium leontopodium* +/-

Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group I +/-

- - Relevé in moist grassland at a plain +

- - Incomplete species lists (11, 12) from the catchment area of Tso Moriri

Gentiana marginata (G.Don) Griseb.; *Bill. & Léon.* 6761: Zoji La, 3450 m. T

Gentiana moorcroftiana Wall.; 2303: E Kartse, Suru Vy., 4160 m, (Nr. 67); 2302: W Sanku, Suru Vy., 3880 m, (Nr. 61); 2428: Wakha Vy. SE Mulbekh, ca. 3700 m; 2429: Tungri, Zaskar, ca. 3600 m. *Klim. & Srut.* (13. 9. 89): Zoji La, 3330 m. T

Table 3: - *Bistorta affinis* community-group V +/-

- - Relevé in grassland dominated by *Kobresia royleana* and *Leontopodium leontopodium* +

Gentiana pedunculata Royle ex Don; 2430: Shagar NW Tungri, Zaskar, ca. 3600 m; 5052: Khardung, Shyok Vy., ca. 3800 m. *Klim. & Srut.* (1. 9. 89): Vy. of Bhaga Riv., Lahul, 4160 m. T

Table 3: - *Bistorta affinis* community-group I +

Gentiana prostrata Haenke; 6026: Camp W Karzok, Tso Moriri, 4560 m; 4082: N Taglang La, 5200 m, (Nr. 239). T

Table 6: - Incomplete species lists (11, 12) from the catchment area of Tso Moriri

Gentiana pseudoaquatica Kusnez.; 3174: N Nimaling, Markha Vy., 4930 m, (Nr. 209); 3175: Ang, Indus Vy., 3600 m; 4078: NW Leh, 3610 m; 4079: Debring, Rupshu, 4830 m, (Nr. 268). T

Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group II +

- - Relevé within higher *Kobresia* grassland I

- - Relevé within *Carex* grassland (Rupshu) 2

Gentiana strachey (C.B.Cl.) Kit.; 2431: SW Tungri, Zaskar, ca. 3850 m. T

Gentiana stricta Klotzsch; 2432: Mulbekh, ca. 3150 m; 5051: Khardung, Shyok Vy., 3800 m. T

Gentiana thomsonii Clarke; 3171: Nimaling, Markha Vy., 4750 m; 4083: Debring, Rupshu, 4900 m. T

Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group +

- - Relevé within *Carex* grassland (Rupshu) 1

Gentiana tianschanica Rupr. ex Kusnez.; 2305: E Kartse, Suru Vy., 4160 m, (Nr. 67); 2433: Pensi La, 4410 m, (Nr. 167); 2304: Yasghun, Dras Vy., 3540 m, (Nr. 9). *Klim. & Srut.* (1. 9. 89): Vy. of Bhaga Riv., Lahul, 4160 m. H

Table 3: - *Bistorta affinis* community-group II-V +/-

- - Relevé of the transitional zone between subalpine steppe and *Bistorta affinis* community +

Table 6: - Community dominated by *Kobresia schoenoides* +

- Community of *Nepeta discolor* / *Festuca kashmiriana* I +

Gentiana umbellata M.Bieb.; 2434: SW Tungri, Zaskar, ca. 3850 m. T

Lomatogonium carinthiacum (Wulf.) A.Br. (*Pleurogyne carinthiaca* (Wulf.) Griseb.); 2301: N Sanmodangsa, Suru Vy., 4050 m, (Nr. 93); 2435: Pensi La, 4360 m, (Nr. 161); 2436: Wakha Vy. SE Mulbekh, ca. 3650 m; 4088: Debring, Rupshu, 4830 m, (Nr. 268); 5050: N Tso Kar, Rupshu, 4600 m. T

Table 3: - Relevé in grassland dominated by *Kobresia schoenoides* and *Agrostis vinealis* 1

Table 6: - Community dominated by *Kobresia schoenoides* II +/-

- - Relevé within *Carex* grassland (Rupshu) 1
- - Incomplete species lists (11, 12) from the catchment area of Tso Moriri

Lomatogonium coeruleum (Royle)H.Sm. (*Swertia coerulea* Royle); 2300: Vy. E of Kartse, Suru Vy., 4160 m, (Nr. 67). H

Table 3: - *Bistorta affinis* community-group IV +-1

Lomatogonium thomsonii (Clarke)Fern.; 4081: S Rumtse, N Taglang La, 4500 m, (Nr. 245). T

Table 6: - Relevé in moist grassland at a plain +

Swertia cordata (D.Don)C.B.Clarke; 3172: N Dras, ca. 3200 m. H

Swertia petiolata Royle ex G.Don; 4077: Rohtang Pass, Lahul, ca. 4000 m. H

Swertia speciosa G.Don var. **perfoliata** (G.Don)Clarke; 2299: Panikhar, Suru Vy., 3300 m. H

Swertia thomsonii Clarke; 2298: W Sanku, Suru Vy., 3880 m, (Nr. 61); 3173: Dras, 3200 m. H

Table 3: - Relevé in grassland dominated by *Kobresia royleana* and *Leontopodium leontopodium* +

Geraniaceae (incl. Biebersteiniaceae)

Biebersteinia odora Steph.; 2034: Alchi Brok, Indus Vy., 4460 m, (Nr. 37); 2765: Vy. of Stok Phu, Indus Vy., 4550 m, (Nr. 120); (8. 8. 87): N Kongmaru La, ca. 4900 m. *Bill. & Léon. 6859*: Tirdik, N Sabu, Indus Vy., 4800 m. H,(G)

Table 4: - Community-group of *Elymus canaliculatus* and *Thermopsis inflata* / *Biebersteinia odora* III 2-3

- *Aconogonon tortuosum*-*Nepeta glutinosa* community 1

Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group I 1

Erodium stephanianum Willd.; 2766: S Leh, ca. 3450 m; 4091: S Hemis, Indus Vy., 3730 m; 5053: above Panamik, Nubra Vy., ca. 3230 m. T

Erodium tibetanum Edgew.; 2035: E Khalsi, Indus Vy., 3160 m, (Nr. 28); 3080: N Leh, 3650 m. *Klim. & Srut .* (5. 9. 89): Upshi, Indus Vy., 3370 m. H

Table 1: - Communities of the lower and higher subalpine desert II +-1

- Relevé in a depression +

Table 4: - *Stipa glareosa*-*Krascheninnikovia pungens* community I +

Geranium himalayense Klotzsch; 2037: Sanmodangsa, Suru Vy., 4190 m, (Nr. 86); 2770: Pensi La, 4360 m, (Nr.163); 2768: W Rumbak, N Indus Vy., ca. 4100 m; 2767: Tungri, Zaskar, 3600 m; 3081: Shingo, Markha Vy., 4130 m; 4092: N above Leh, 3540 m. *Moh. Deen* (11. 8. 92): Shergol, W-Ladakh. H

Table 3: - Grassland dominated by *Carex melanantha* V 1-2

- Community-group of *Festuca kashmiriana* and *Poa suruana* +-III r-1

- - Relevé in grassland dominated by *Kobresia schoenoides* and *Agrostis vinealis* +

Table 6: - Community of *Nepeta discolor* / *Festuca kashmiriana* IV +-3

Geranium pratense L.ssp. **stewartianum** Y.Nasir; 2036: cf.: S Matayan, Dras Vy., 3550 m, (Nr. 4); 3082: Dras, 3200 m. H

Table 3: - Relevés within community of *Koeleria cristata* and *Stipa pennata* ssp.*kirghisorum* +/-1

Geranium cf. **regelii** Nevski; 2039: cf.: E Kartse, Suru Vy., 3830 m, (Nr. 66); 2038: Matho Phu, Indus Vy., 4450 m, (Nr. 43); 3083: cf.: Tchatchutse, Markha Vy., 4400 m; 5054: N Khardung La, 4550 m, (Nr. 284). *Bill. & Léon. 6773*: Dras, 3100 m. H Identity uncertain.

Table 2: - Community dominated by *Artemisia brevifolia* I +

Table 3: - *Bistorta affinis* community-group III +

- - Relevé within the transitional zone between subalpine steppe and *Bistorta affinis* community +

Table 4: - Community-group of *Potentilla bifurca* / *Artemisia gmelinii* +

Table 5: - *Caragana* community of the region of Kanda La and Matho Phu I 1

Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group I 1

Grossulariaceae

Ribes himalense Decne.; 2809: middle of Wakha Vy., SE Mulbekh ca. 3600 m. NP

Ribes nigrum L.; 2808: SW Tungri, Zaskar, ca. 3700 m; (12. 7. 87): E of Dras. NP

Ribes orientale Desf.; 2810: Wakha Vy., 3600 m; 5079: S Hemis, Indus Vy., 3880 m; 6027: ca. 1 km N above Nang, Indus Vy., 3920 m. NP

Hippuridaceae

Hippuris vulgaris L.; 4122: Shey, Indus Vy., ca. 3300 m. A

Iridaceae

Iris oxypetal Bunge (*I. ensata* auct.); 2719: N Leh, 3600 m; 3045: N above Leh, 3650 m. Bill. & Léon. 6814: Alchi, Indus Vy., 3000 m. G

Iris hookeriana Foster; Matayan, Dras Vy., 3550 m. G

Table 3: - Relevés within community of *Koeleria cristata* and *Stipa pennata* ssp. *kirghisorum* +/-

Juncaceae

Juncus articulatus L.; 4125: below Shey, Indus Vy., ca. 3300 m. H

Juncus bufonius L.; 2711: Wakha Vy., ca. 3500 m; 4124: W Choglamsar, Indus Vy., ca. 3250 m; 4196: NW Sankar above Leh, 3630 m. T

Juncus leucomelas Royle ex D. Don; 3046: Nimaling, Markha Vy., 4750 m; 2712: S of Stok, Indus Vy., 4000 m. G

Juncus membranaceus Royle ex D. Don; 2713: middle of Wakha Vy., ca. 3600 m. G

Juncus thomsonii Buchen.; 4123: S Rumtse, N Taglang La, ca. 4500 m; 6028: riverside N Karzok, Tso Moriri, 4560 m. G

Table 6: - Incomplete species list (11) from the catchment area of Tso Moriri

Juncaginaceae

Triglochin palustre L. 3047: E Ski, Markha Vy., 3580 m; 4128: S Rumtse N Taglang La, 4500 m. Bill. & Léon. 6849: Shey, Indus Vy., 3300 m. H

Triglochin maritima L.; 2706: Mulbekh, ca. 3200 m; 4127: S Rumtse, N Taglang La, 4500 m. H

Lamiaceae (Labiatae)

Dracocephalum heterophyllum Benth.; 2295: Matho Phu, Indus Vy., 4380 m, (Nr. 39); 2467: N Kanda La, 4600 m; 2466: S Stok Phu, Indus Vy., 4640 m, (Nr. 123); 3178: Shingo, Markha Vy., 4150 m. H,G

Table 4: - Within most of the alpine steppe and semidesert communities +/-III r-2

Table 5: - *Artemisia minor*-*Potentilla pami*rica community V +/-1

- *Caragana* community of the region: Taglang La – Rupshu III +/-1

Table 6: - *Poa attenuata*-*Potentilla pami*rica community-group +

Dracocephalum nutans L.; 2465: Zoji La, 3700 m. H,G

Dracocephalum stamineum Kar. et Kir.; 2463: N Kanda La, ca. 4800 m. H,G

Elsholtzia ciliata (Thunb.) Hylander (*E. cristata* Willd.); Klim. & Srut. (13. 9. 89): Zoji La, 3330 m. T

Elsholtzia eriostachya Benth. var. *pusilla* (Benth.) Hook.f.; 2451: N Kanda La, 4540 m; 4130: N Taglang La, 4870 m, (Nr. 241). T

Table 5: - *Caragana* communities of the regions of Taglang La – Rupshu as well as Kanda La and Matho Phu I-III +/-2

Table 6: - *Poa attenuata*-*Potentilla pami*rica community-group I +/-2

Lamium amplexicaule L.; 4132: N Sankar, above Leh, 3610 m. T,H

Marmoritis nivalis (Jacq. ex Benth.) Hedge comb. nov.; 5056: N below Lachalung La, Rupshu, 4950 m. H,(G)

Marmoritis rotundifolia Benth. (*Nepeta tibetica* Benth.); 2464: S Stok Phu, Indus Vy., 4710 m, (Nr. 124); (8. 8. 87): S of Kongmaru La, 5100 m. H,(G)

Table 4: - Community-group of *Elymus canaliculatus* and *Thermopsis inflata* / *Biebersteinia odora* I +

Marrubium marrubiastrum (Steph.) Hedge; 5055: Tso Kar, Rupshu, 4760 m, (Nr. 299). H

Table 4: - Community-group of *Krascheninnikovia pungens* / *Ptilotrichum canescens* +

Table 5: - *Caragana* community of the region: Taglang La – Rupshu I +

Mentha royleana Benth. in Wall. (*M. longifolia* auct.); 2297: Mulbekh, ca. 3350 m; 2461: Mulbekh, ca. 3200 m; 3180: Dras, 3200 m. H,G

Nepeta annua Pallas; 4133: SW below Hemis, Indus Vy., 3450 m, (Nr. 220). T

Table 1: - Communities of the higher subalpine desert +

Nepeta coerulescens Maxim. (*N. thomsonii* Benth.); 6031: about 11 km E of Tsoltak, N Chang La, 4600 m. H₁(G)

Nepeta connata Royle ex Benth.; 3177: Dras, 3200 m. *Klim. & Srut.* (13. 9. 89): Zoji La, 3330 m. H

Nepeta discolor Royle ex Benth.; 2292: SE Matayan, Dras Vy., 3450 m, (Nr. 5); 2291: SW Dras, 3450 m, (Nr. 1); 2293: W Panikhar, Suru Vy., 3450 m, (Nr. 110); 2290: Sanmodangsa, Suru Vy., 3950 m, (Nr. 81). *Klim. & Srut.* (31. 8. 89): Vy. of Bhaga River, Lahul, 3250 m and 4160 m. H₁(G)

Table 2: - in nearly all steppe communities of the subalpine belt +-V r-3

Table 3: - in most of the subalpine turf and steppe-meadow communities II-V +-3

Table 4: - Community-group of *Potentilla bifurca* / *Artemisia gmelinii* III r-2

- *Stipa purpurea*-*Carex moorcroftii* community III r-2

- Community-group of *Elymus canaliculatus* and *Potentilla bifurca* I-II +

- *Aconogonon tortuosum*-*Nepeta glutinosa* community I +-1

Table 6: - Community of *Nepeta discolor* / *Festuca kashmiriana* V +-3

- *Poa attenuata*-*Potentilla pamirica* community-group I-II +-1

Nepeta eriostachys Benth. var. *rohtangensis* Aswal; 4129: S Rohtang Pass, ca. 3600 m. H₁(G)

Nepeta floccosa Benth.; 2289: S Mulbekh, 3700 m; 2459: Yurutse, S of Indus Vy., 4180 m, (Nr. 144). *Bill. & Léon.* 6803: Lamayuru, 3600 m; 6813: Khalsi, Indus Vy., 2950 m. *Klim. & Srut.* (8. 9. 89): Saspul, Indus Vy., 3170 m; (4. 9. 89): Upshi, Indus Vy., 3390 m. H₁(G)

Table 1: - Communities of the lower and higher subalpine desert IV +-2

Table 2: - *Stachys tibetica* community II +-1

- Communities dominated by *Artemisia brevifolia* I +

- Community of *Koeleria cristata* / *Tanacetum artemisioides* +

Table 4: - *Stipa glareosa*-*Krascheninnikovia pungens* community I 2

Nepeta glutinosa Benth.; 2294: Alchi Brok, Indus Vy., 4030 m, (Nr. 31); 4131: SW Götsang Gompa, Indus Vy., 4300 m, (Nr. 225); 2458: S Tungri, Zaskar, 4000 m, (Nr. 157). H₁(G)

Table 1: - *Artemisia* steppe of a transitional zone to the alpine belt III r-2

Table 2: - Community dominated by *Artemisia brevifolia* +

- Community of *Artemisia wellbyi* / *Lindelofia anchusoides* +

- Relevé of the *Stachys tibetica* community +

Table 4: - *Aconogonon tortuosum*-*Nepeta glutinosa* community V +-3

Nepeta leucolaena Benth. ex Hook. f. (*N. royleana* R.R. Stewart); 2460: NW Rumbak, S of Indus Vy., 3800 m; 2288: Alchi Brok, Indus Vy., 4030 m, (Nr. 31); 3179: E Yangtang, Indus Vy., 3760 m; 4134: E above Sabu, Indus Vy., 3780 m. *Klim. & Srut.* (12. 9. 89): 15 km E of Dras, 2960 m. Ch, H

Table 1: - Communities of the higher subalpine desert I r-2

- *Artemisia* steppe of a transitional zone to the alpine belt III 1-2

- Relevé within a transitional zone to the alpine belt N of Likir +

Table 2: - Community of *Artemisia brevifolia* / *Tanacetum fruticosum* IV r-2

- *Stachys tibetica* community III +-2

- Relevés in community devoid of or with only sporadic *Artemisia brevifolia* +/-

Nepeta longibracteata Benth.; 2462: N Kanda La, ca. 4850 m; 3176: S Kongmaru La, 5100 m, (Nr. 212); 5057: N Khardung La, ca. 5100 m; 6030: S Tsoltak, N of Chang La, 5150 m, (Nr. 326). H₁(G)

Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group +-III +

Perovskia abrotanoides Karel.; 2457: S Leh, 3430 m; 3183: Sabu, Indus Vy., ca. 3500 m; (29. 7. 92): Phiyang, Indus Vy., 3450 – 3600 m. *Bill. & Léon.* 6805: Khalsi, Indus Vy., 2950 m. Ch

Table 1: - Community of the higher subalpine desert r

Table 2: - Relevé in the low subalpine steppe-desert +

Scutellaria heydei Hook. f.; *Moh. Deen* (12. 8. 92): Sapi, W of Mulbekh. H, G

Stachys tibetica Vatke; 2287: S Mulbekh, 3310 m, (Nr. 13). *Klim. & Srut.* (4. 9. 89): S Upshi, Indus Vy., 3390 m; (10. 9. 89): Fotu La, 3800 m; (13. 9. 89): Dras, 3330 m. Ch

Table 1: - in all communities of the higher subalpine desert III +-2

Table 2: - *Stachys tibetica* community V +-3

- Community of *Artemisia brevifolia* / *Tanacetum fruticosum* III r-1

- Relevés in the low subalpine steppe-desert +/2

Table 4: - *Aconogonon tortuosum*-*Nepeta glutinosa* community I 2

Thymus linearis Benth. ssp. *linearis* Jasas; 2453: Dzongkhul, Zaskar, 3800 m; 2285: SW Sanku, Suru Vy., 3460 m, (Nr. 58); 2284: S Mulbekh, 3570 m, (Nr. 12); 2283: S Yasghun, Dras Vy., 3520 m, (Nr. 7); 2282: SW Dras, 3450 m, (Nr. 1); 2286: E Kartse, Suru Vy., 4060 m, (Nr. 69). Ch

Table 2: - Community devoid of or with only sporadic *Artemisia brevifolia* IV +-1

- Community of *Koeleria cristata* / *Tanacetum artemisioides* III +-2
 - Community dominated by *Artemisia brevifolia* II r-1
 - Community of *Artemisia wellbyi* / *Lindelofia anchusoides* I +
 - *Stachys tibetica* community I +
- Table 3: - *Bistorta affinis* community-group II-III +-3
- *Artemisia brevifolia*-*Cicer microphyllum* community I +
 - Relevé in community-group of *Festuca kashmiriana* and *Poa suruana* I
- Table 4: - *Aconogonon tortuosum*-*Nepeta glutinosa* community +

Lentibulariaceae

Utricularia australis R.Brown; 4197: below Shey, Indus Vy., ca. 3300 m. A

Liliaceae (incl. Alliaceae)

Allium carolinianum DC. (*A. thomsonii* Baker); *Bill. & Léon. 6763*: between Zoji La and Dras, 3300 m. G

Allium oreoprasum Schrenk; 2718: middle of Wakha Vy., 3650 m; 2717: W Rumbak, S Indus Vy., 4000 m; 3048: Tchatchutse, Markha Vy., 4340 m, (Nr. 199). G

Table 4: - Community of *Stipa breviflora* / *Tanacetum fruticosum* I 1

Allium przewalskianum Regel; 3049: Tchatchutse, Markha Vy., 4560 m, (Nr. 196); 5058: Khardung, Shyok Vy., ca. 3800 m; 6029: about 8 km E of Tsoltak, N Chang La, 4710 m, (Nr. 320). G

Table 2: - Community of *Artemisia brevifolia* / *Tanacetum fruticosum* +

Table 4: - Community of *Stipa breviflora* / *Tanacetum fruticosum* III +

- Community-group of *Potentilla bifurca* / *Artemisia gmelinii* I r-2

Eremurus himalaicus Baker; *Bill. & Léon. 6762*: between Zoji La and Dras, 3300 m. *H. Hartmann* (12. 7. 87): between Matayan and Dras very common, in full flower! G

Gagea elegans Wall.ex D.Don; 4135: SE Taglang La, Rupshu, 5130 m, (Nr. 265). G

Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group +

Gagea gracillima Pamp.; *Bill. & Léon. 6866*: Tirdik N Sabu, Indus Vy., 4800 m. G

Lloydia serotina (L.)Reichenb.; *Bill. & Léon. 6863*: Tirdik N Sabu, Indus Vy., 4800 m. G

Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group II +-1

Morinaceae

Morina coulteriana Royle; 2032: S Mulbekh, 3740 m, (Nr. 10); 2482: Wakha Vy., SE Mulbekh, 3550 m. H

Table 2: - Community of *Koeleria cristata* / *Tanacetum artemisioides* I r-+

Onagraceae

Epilobium angustifolium L.; 2029: Sanmodangsa, Suru Vy., 4040 m, (Nr. 82). H

Table 3: - Community-group of *Festuca kashmiriana* and *Poa suruana* V +-1

- Grassland dominated by *Carex melanantha* V +-1
- *Artemisia brevifolia*-*Cicer microphyllum* community IV +

Table 6: - Community of *Nepeta discolor* / *Festuca kashmiriana* I +

Epilobium latifolium L.ssp. *speciosum* (Dcne.)Raven (*Chamaenerion latifolium* (L.)Th.Fr. & Lange); 2777: W Tungri, Zanskar, ca. 3650 m. *Klim. & Srut.*(1. 9. 89): Vy. of Bhaga River, Lahul, 4520 m. H, Ch

Epilobium laxum Royle; 2030: Sanmodangsa, Suru Vy., 4050 m, (Nr. 93); 2031: W above Sanku, Suru Vy., 4030 m, (Nr. 63). H

Table 3: - Relevé in grassland dominated by *Kobresia schoenoides* and *Agrostis vinealis* 1

- Relevés in grassland dominated by *Kobresia royleana* and *Leontopodium leontopodium* +/-

Epilobium minutiflorum Hausskn.; 4136: N Leh, ca. 3540 m. H

Epilobium royleanum Hausskn. (*E. himalayense* Hausskn., *E. roseum* var. *indicum* C.B.Clarke); *Klim. & Srut.* (9. 9. 89): Khalsi, Indus Vy., 2900 m. H

Orchidaceae

Dactylorhiza hatagirea (D.Don)Soó; 2722: middle of Wakha Vy., SE Mulbekh, 3600 m; (5. 8. 95): Panamik, Nubra- Vy., 3200 m. G

Epipactis helleborine (L.)Crantz; 2723: middle of Wakha Vy., 3650 m. G

Herminium monorchis (L.)R.Br.; 5059: Panamik, Nubra Vy., ca. 3200 m. G

Orobanchaceae

Orobanche cernua Loefl.; 2415: SW Tungri, Zaskar, 3920 m, (Nr. 155); 2416: SW Tungri, 3760 m, (Nr. 153).
Bill. & Léon. 6785: Kargil, 2950 m. G

Table 2: - Community dominated by *Artemisia brevifolia* +
- Community of *Artemisia wellbyi* / *Lindelofia anchlussoides* +

Papaveraceae

Meconopsis aculeata Royle; 2641: near Dzongkhul Gompa, Zaskar, 3800 m. G

Parnassiaceae

Parnassia laxmannii Pallas ex Schultes (*P. ovata* sensu Hook.f.et Th.); 2206: W Sanku, Suru Vy., 3380 m, (Nr. 61). H

Table 3: - Relevés in grassland dominated by *Kobresia royleana* and *Leontopodium leontopodium* +/-

Parnassia nubicola Wall.ssp. *occidentalis* E.S.Tem.; 2807: Wakha Vy., SE Mulbekh, 3600 m. H

Parnassia pusilla Wall.ex Arn.; 6043: W above Karzok, Tso Moriri, 4560 m. H

Table 6: - Incomplete species list (11) from the catchment area of Tso Moriri

Plantaginaceae

Plantago depressa Willd. (*P. tibetica* Hook.f.et Th.); 4153: SW Choglamsar, S Leh, 3300 m; 5065: Panamik, Nubra Vy., 3220 m. H,T

Plantago gentianoides Sibth.et Smith cf.ssp. *griffithii* (Dcne.)Rech.f.; 2486: upper Wakha Vy., SE Mulbekh, ca. 3750 m. H

Plantago himalaica Pilger; 2024: W Sanku, Suru Vy., 4030 m, (Nr. 63); 2487: Tungri, Zaskar, 3600 m. H

Table 3: - Relevé in grassland dominated by *Kobresia royleana* and *Leontopodium leontopodium* +

Plumbaginaceae

Acantholimon lycopodioides Boiss.; 2023: SW Dras, 3450 m, (Nr. 1). *Bill. & Léon. 6844*: Götsang above Hemis, Indus Vy., 4000 m; 6787: Namika La, 3700 m. *Klim. & Srut. (10. 9. 89)*: Fotu La, 3890 m. Ch

Table 1: - *Artemisia* steppe of a transitional zone to the alpine belt V r-1
- Communities of the higher subalpine desert r

Table 2: - Community dominated by *Artemisia brevifolia* IV +-2
- Community of *Artemisia brevifolia* / *Tanacetum fruticosum* III r-1
- Community of *Koeleria cristata* / *Tanacetum artemisioides* III r-2
- Relevés of the *Koeleria cristata* community +/-2
- Relevé within a transitional zone to the alpine belt on Fotu La 3

Table 3: - *Bistorta affinis* community-group II r-1

Table 4: - Community-group of *Elymus canaliculatus* and *Potentilla bifurca* III-V r-3
- Community-group of *Potentilla bifurca* / *Artemisia gmelinii* III r-3
- *Aconogonon tortuosum*-*Nepeta glutinosa* community II +-2
- Community-group of *Elymus canaliculatus* and *Thermopsis inflata* / *Biebersteinia odora* I r

Dictyolimon macrorhabdos (Boiss.)Rech.f. (*Statice macrorhabdos* Boiss.); 4045: below Götsang Gompa, Indus Vy., ca. 3850 m. T,H

Poaceae (Gramineae)

Agrostis gigantea Roth; 6050: N of Sankar / Leh, ca. 3600 m. H

Agrostis stolonifera L.s.l.; 2548: Tungri, Zaskar, 3600 m; 3012: below Tingsmogang, Indus Vy., 3350 m. H

Agrostis vinealis Schreb.; 2327: W Sanku, Suru Vy., 3880 m, (Nr.61); 2326: W Panikhar, Suru Vy., 3640 m, (Nr. 102); 2325: N Sanmodangsa, Suru Vy., 4050 m, (Nr. 93); 2580: near Dzongkhul Gompa, Zaskar, 3800 m, (Nr. 151); 2328: SW Sanku, Suru Vy., 3460 m, (Nr. 58). *Klim. & Srut. (13. 9. 89)*: Zoji La, 3330 m. H

Table 2: - Community devoid of or with only sporadic *Artemisia brevifolia* II 1-3
- Community of *Artemisia wellbyi* / *Lindelofia anchlussoides* I r-+
- Relevé of the *Koeleria cristata* community 2

Table 3: - *Bistorta affinis* community-group II +-2

- - Relevé in grassland dominated by *Kobresia schoenoides* and *Agrostis vinealis* 3
 - - Relevé in grassland dominated by *Carex pseudofoetida* 2
 - - Relevés in grassland dominated by *Kobresia royleana* and *Leontopodium leontopodium* 2/1
- Alopecurus arundinaceus*** Poir.; 2344: W Sanmodangsa, Suru Vy., 4190 m, (Nr. 86). H,(G)
- Table 3: - Grassland dominated by *Carex melanantha* V +-1
 - Community-group of *Festuca kashmiriana* and *Poa suruana* +-III +-1
 - - Relevé in grassland dominated by *Kobresia schoenoides* and *Agrostis vinealis* 1
- Avena byzantina*** C.Koch; 6051: W above Karzok, Tso Moriri, 4560 m. T
- Bothriochloa ischaemum*** (L.)Keng; 2552: S Leh, ca. 3450 m. H
- Bromus confinis*** Nees ex Steud.; 2361: S Matayan, Dras Vy., 3550 m, (Nr. 4). H
- Table 3: - Community of *Koeleria cristata* and *Stipa pennata* ssp.*kirghisorum* 1/+
 - - Relevé of a transitional zone between subalpine steppe and *Bistorta affinis* community +
- Table 4: - *Aconogonon tortuosum*-*Nepeta glutinosa* community I +
- Bromus gracillimus*** Bunge; 2581: between Pensi La and Tungri, Zanskar, 3850 m. T
- Bromus oxyodon*** Schrenk; 2362: W Panikhar, Suru Vy., 3350 m, (Nr. 108); 2363: W Sanku, Suru Vy., 3320 m, (Nr. 57); 2553: between Pensi La and Tungri, Zanskar, 3850 m. *Klim. & Srut.* (12. 9. 89): Vy. of Dras, 2930 m; (31. 8. 89): Vy. of Bhaga River, Lahul, 3170 m. T
- Table 2: - Community dominated by *Artemisia brevifolia* II +-1
 - Community devoid of or with only sporadic *Artemisia brevifolia* V +-2
 - Community of *Artemisia wellbyi* / *Lindelofia anchusoides* III +-1
 - *Stachys tibetica* community I +
- Table 3: - *Artemisia brevifolia*-*Cicer microphyllum* community I +
 - Community-group of *Festuca kashmiriana* and *Poa suruana* I +
- Bromus tectorum*** L.; 2360: W Panikhar, Suru Vy., 3350 m, (Nr. 108). T
- Table 2: - *Stachys tibetica* community II +
 - Community of *Koeleria cristata* / *Tanacetum artemisioides* +
 - - Relevés of a rock debris community devoid of or with only sporadic *Stachys tibetica* 1/+
 - - Relevé in the low subalpine steppe-desert +
- Calamagrostis epigejos*** (L.)Roth; 2359: Sanmodangsa, Suru Vy., 4040 m, (Nr. 82). H,G
- Table 3: - Community-group of *Festuca kashmiriana* and *Poa suruana* V +-3
 - *Artemisia brevifolia*-*Cicer microphyllum* community IV 1-2
- Calamagrostis holciformis*** Jaub.et Spach; 4110: above Rumtse, N Taglang La, 4500 m, (Nr. 245); 4111: SE Rumtse, 4500 m; 5015: Lachalung La, Rupshu, 5065 m. H,G
- Table 6: - Relevé in moist grassland at a plain 3
 - Relevé within *Carex* grassland (Rupshu) 1
 - Incomplete species lists (10, 12) from Lachalung La and from the catchment area of Tso Moriri
- Calamagrostis pseudophragmites*** (Hall.f.)Koel.ssp. *tartarica* (Hook.f.)Tzvelev; 2546: Mulbekh, ca. 3170 m; 2545: Wakha Vy. SE Mulbekh, 3600 m; 4093: E Choglamsar, Indus Vy., ca. 3300 m. H,G
- Calamagrostis pulchella*** Griseb.; 2547: Pensi La, 4330 m, (Nr. 180); previously used as *C. stoliczkae* Hook.f. x *arundinacea* (L.)Roth ! H,G
- Table 6: - Community of *Nepeta discolor* / *Festuca kashmiriana* I 1
- Catabrosa aquatica*** (L.)P.Beauv.; 5004: N Tso Kar, Rupshu, 4600 m; 5007: S above Matho, Indus Vy., 3700 m; 6049: NW shore of Pangong Tso, 4250 m. H,G
- Cymbopogon jwarancusa*** (Jones)Schult.ssp. *jwarancusa* T.A.Cope; *Bill. & Léon.* 6892: Rizong Riv. N of River Indus, 3150 m. H
- Danthonia* cf. *cumminsii*** Hook.f.; *K. Prach* (31. 8. 89): Vy. of Bhaga River, Lahul, 3250 m. H
- Elymus canaliculatus*** (Nevski)Tzvelev (*E. longearistatus* ssp. *canaliculatus* (Nevski)Tzvel.); 2333: Yasghun, Vy. of Dras, 3520 m, (Nr. 7); 2334: S Namika La, 3880 m, (Nr. 16); 2335: Sanmodangsa, Suru Vy., 3940 m, (Nr. 83); 4097: N Likir, Indus Vy., 4020 m, (Nr. 272); 4098: above Götsang Gompa, Indus Vy., 4300 m, (Nr. 225); 5017b: S above Khardung village, Shyok Vy., 4440 m, (Nr. 282). H
- Table 1: - Communities of the higher subalpine desert +-IV +-2
 - - Relevé within a transitional zone to the alpine belt N of Likir 1
- Table 2: - in nearly all communities of the subalpine steppe II-III +-2
- Table 3: - *Bistorta affinis* community-group II +-1

- *Artemisia brevifolia*-*Cicer microphyllum* community IV +-2
- Community-group of *Festuca kashmiriana* and *Poa suruana* II 1-2
- Table 4: - Community-group of *Elymus canaliculatus* and *Potentilla bifurca* V +-2
- Community-group of *Elymus canaliculatus* and *Thermopsis inflata* / *Biebersteinia odora* V +-1
- *Aconogonon tortuosum*-*Nepeta glutinosa* community V +-2
- Community of *Stipa breviflora* / *Tanacetum fruticosum* I +
- Community-group of *Potentilla bifurca* / *Artemisia gmelinii* I +-1
- Table 5: - *Caragana* community of the region: Matho Phu and Kanda La III +-2
- Table 6: - Community of *Nepeta discolor* / *Festuca kashmiriana* IV +-2
- *Poa attenuata*-*Potentilla pamirica* community-group I 1
- Community dominated by *Kobresia schoenoides* +
- Elymus cognatus*** (Hackel)T.A.Cope; 2332: SW Dras, 3450 m, (Nr. 1); 2331: W Panikhar, Suru Vy., 3350 m, (Nr. 108); 2550: Tungri, Zanskar, 3640 m, (Nr. 149); 2549: SW Tungri, Zanskar, 3870 m, (Nr. 154); previously used as *E. repens* (L.)Gould ! G,(H)
- Table 2: - Community of *Koeleria cristata* / *Tanacetum artemisioides* IV +-1
- Community dominated by *Artemisia brevifolia* III +-2
- Community devoid of or with only sporadic *Artemisia brevifolia* V +-2
- *Stachys tibetica* community II +-1
- Table 3: - Relevé in community of *Koeleria cristata* and *Stipa pennata* ssp.kirghisorum 1
- Table 4: - *Aconogonon tortuosum*-*Nepeta glutinosa* community III +
- Elymus dentatus*** (Hook.f.)Tzvel.; 2612: Pensi La, 4370 m, (Nr. 178); 3014a: N Leh, ca. 3650 m. According to *B.Dickoré* probably *E. stewartii* (Meld.)Cope ! H
- Table 6: - Community of *Nepeta discolor* / *Festuca kashmiriana* I +
- Elymus fedtschenkoi*** Tzvel.; 2336: S Matayan, Dras Vy., 3550 m, (Nr. 4). H
- Table 3: - Relevé in community of *Koeleria cristata* and *Stipa pennata* ssp.kirghisorum +
- Elymus x incertus*** Hartmann hybr.nov.; 2613:(Typus): S Tungri, Zanskar, 4000 m, (Nr. 157). H,(G)
- Table 2: - Community dominated by *Artemisia brevifolia* +
- Elymus jacquemontii*** (Hook.f.)Tzvel.; 3019: Nimaling, Markha Vy., 4960 m, (Nr. 208); 4095: SE Taglang La, 4820 m, (Nr. 252); 4096: N Taglang La, 4950 m, (Nr. 231); 3020: S Tchatchutse, Markha Vy., 4530 m, (Nr. 198); 5019: NW Tso Kar, Rupshu, 4630 m, (Nr. 298); 5018: Norbo, More Plain, 4830 m, (Nr. 306); 5017a: S above Khardung village, Shyok Vy., 4440 m, (Nr. 282); 6053: ca. 3 km S above Karzok Phu, Tso Moriri, 4750 m, (Nr. 338); 6054: ca. 2 km S of Kiagar La, Rupshu, 4780 m, (Nr. 334). H
- Table 4: - Community-group of *Krascheninnikovia pungens* / *Ptilotrichum canescens* I-III +-2
- *Stipa purpurea*-*Carex moorcroftii* community III 1-2
- Community-group of *Potentilla bifurca* / *Artemisia gmelinii* II +-2
- *Stipa glareosa*-*Krascheninnikovia pungens* community I +
- Table 5: - *Artemisia minor*-*Potentilla pamirica* community IV +
- *Caragana* community of the region: Taglang La – Rupshu IV +-2
- Relevé in the catchment area of Tso Moriri 1
- Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group II +-2
- Relevé within *Carex* grassland (Rupshu) 1
- Elymus nutans*** Griseb.; 2562a: N Kanda La, 4550 m, (Nr. 133); 2561: Mulbekh, ca. 3170 m; 2560: N Leh, 3600 m; 3015: N Leh, ca. 3650 m; 3016: S Tchatchutse, Markha Vy., 4530 m, (Nr. 198); 4099: SE Rumtse, N Taglang La, 4550 m, (Nr. 229). H
- Table 4: - Community of *Stipa breviflora* / *Tanacetum fruticosum* II +
- Community-group of *Krascheninnikovia pungens* / *Ptilotrichum canescens* I +
- *Stipa glareosa*-*Krascheninnikovia pungens* community I +
- Table 5: - *Caragana* community of the region of Matho Phu and Kanda La III 1-2
- Table 6: - Incomplete species list (12) from the catchment area of Tso Moriri
- Elymus schrenkianus*** (Fisch.et Mey.)Tzvel.; 3017: S Nimaling, Markha Vy., 5170 m, (Nr. 204); 3018: Nimaling, 4800 m, (Nr. 206). H
- Table 4: - Community-group of *Potentilla bifurca* / *Artemisia gmelinii* +
- Table 5: - *Caragana* community of the region: Taglang La – Rupshu I 2
- Relevés in the *Caragana* community at the high valley of Nimaling 1/1
- Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group I +
- Elymus schugnanicus*** (Nevski)Tzvel.; 2551: N Kanda La, 4570 m, (Nr. 134); 5016: S Khardung La, Indus Vy., 4530 m; 6052: about ½ km S Zingrul, S Chang La, 4680 m, (Nr. 340). H
- Table 2: - Community of *Artemisia brevifolia* / *Tanacetum fruticosum* II +-2

Table 4: - Community-group of *Potentilla bifurca* / *Artemisia gmelinii* III +-2

- - Relevé in a succession stage of *Artemisia wellbyi* +

Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group I +-2

Elymus stewartii (Meld.)T.A.Cope; 3014: N Leh, ca. 3650 m. H

Eragrostis minor Host; 2578: S Leh, ca. 3450 m; 5020: S Matho, Indus Vy., 3650 m. T

Eremopoa altaica (Trin.)Rozhev. ssp. *songarica* (Schrenk)Tzvel.; 2579: below Dzongkhul Gumpa, Zanskar, 3800 m; 5021: N Tisseru near Leh, 3650 m. *Klim. & Srut.* (13. 9. 89): Zoji La, 3330 m; (31. 8. 89) : Vy. of Bhaga River, Lahul, 3250 m; (2. 9. 89): Baralacha La, Lahul, 4640 m. T

Festuca alaica Drobow (previously *F. coelestis* (St.-Yves)Krecz.et Bobr.p.p.); 2878: SW Dras, 3450 m,(Nr. 1); 2879: Yasghun, Dras Vy., 3540 m, (Nr. 8); 2880: S Yasghun, 3520 m, (Nr. 7); 2881: SW Matho Phu, Indus Vy., 4470 m, (Nr. 44); 2882: Alchi Brok, Indus Vy., 4460 m, (Nr. 37); 2883: E Kartse, Suru Vy., 4160 m, (Nr. 67); 2616: S Tungri, Zanskar, 4000 m, (Nr. 157); 2618: Pensi La, 4360 m, (Nr. 161); 5022: N Khardung La, Shyok Vy., 4550 m, (Nr. 284); 5023: S Khardung La, Indus Vy., 4530 m, (Nr. 290). *Klim. & Srut.* (10. 9. 89): Fotu La, 3920 m. H

Table 2: - Community of *Koeleria cristata* / *Tanacetum artemisioides* III +-1

- Community dominated by *Artemisia brevifolia* II +-2

- Community devoid of or with only sporadic *Artemisia brevifolia* I 1

Table 3: - *Bistorta affinis* community-group V +-2

- Transitional zone between subalpine steppe and *Bistorta affinis* community 2/1

Table 4: - Community-group of *Potentilla bifurca* / *Artemisia gmelinii* II +-2

- Community-group of *Elymus canaliculatus* and *Potentilla bifurca* +

- *Aconogonon tortuosum*-*Nepeta glutinosa* community + 1

Table 5: - *Caragana* community of the region of Matho Phu and Kanda La I +

Table 6: - Community dominated by *Kobresia schoenoides* III +-1

- *Poa attenuata*-*Potentilla pamirica* community-group I +

Festuca hartmannii (Markgr.-Dbg.)Alexeev; *Klim. & Srut.* (2. 9. 89): Baralacha La, Lahul, 4640 m. H

Festuca kashmiriana Stapf; 2876: N Sanmodangsa, Suru Vy., 4190 m, (Nr. 87); 2877: N Sanmodangsa, 4190 m, (Nr. 86); 2615: SW Tungri, Zanskar, 4120 m, (Nr. 156); 2617: Pensi La, 4360 m, (Nr. 163). *Klim. & Srut.* (30. 8. 89): SW Darcha, Lahul, 3650 m; (1. 9. 89): Vy. of Bhaga River, Lahul, 4160 m and 4520 m. H

Table 2: - Community dominated by *Artemisia brevifolia* I +-2

Table 3: - Community-group of *Festuca kashmiriana* and *Poa suruana* V +-4

- Grassland dominated by *Carex melanantha* V +-2

Table 6: - Community of *Nepeta discolor* / *Festuca kashmiriana* IV 1-3

- Community dominated by *Kobresia schoenoides* +

Festuca nitidula Stapf; 6063: W above Karzok, Tso Moriri, 4560 m. H

Festuca olgae (Regel)Krivot. (*Leucopoa albida* (Turcz.)Krecz.et Bobr.); 2355: Alchi Brok, Indus Vy., 4460 m, (Nr. 37); 2354: E of Kartse, Suru Vy., 4140 m, (Nr. 68); 2567a: Pensi La, 4380 m, (Nr. 162); 2566a: Stok Phu, Indus Vy., 4550 m, (Nr. 120). H

Table 3: - *Bistorta affinis* community-group IV +-3

Table 4: - Community-group of *Elymus canaliculatus* and *Thermopsis inflata* / *Biebersteinia odora* II +

- Community-group of *Elymus canaliculatus* and *Potentilla bifurca* +

- - Relevé in *Aconogonon tortuosum*-*Nepeta glutinosa* community 1

Table 5: - *Artemisia minor*-*Potentilla pamirica* community II +

- *Caragana* community of the region of Taglang La and Rupshu II +-1

Table 6: - Community of *Nepeta discolor* / *Festuca kashmiriana* III 2-3

- Community dominated by *Kobresia schoenoides* II r+

- *Poa attenuata*-*Potentilla pamirica* community-group + +-3

Festuca rubra L.ssp. *arctica* (Hackel)Govor.(*F. kirilowii* Steudel); 2874: W Sanku, Suru Vy., 3880 m, (Nr. 61); 2875: E Kartse, Suru Vy., 4160 m, (Nr. 67); 3021: N Leh, ca. 3600 m. H

Table 2: - Community dominated by *Artemisia brevifolia* +

Table 3: - *Bistorta affinis* community-group III +

- - Relevés in grassland dominated by *Kobresia royleana* and *Leontopodium leontopodium* 1/2

Festuca tibetica (Stapf)Alexeev; 3022: Nimaling, Markha Vy., 4960 m, (Nr. 208); 3023: Nimaling, 4860 m, (Nr. 201); 4100: SE Taglang La, 5050 m, (Nr. 261). H

Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group I-IV +-2

Helictotrichon hookeri (Scribner)Henrard (*H. pratense* auct.); 2330: S Matayan, Dras Vy., 3550 m, (Nr. 4); 2329: E of Kartse, Suru Vy., 4060 m, (Nr. 69). H

Table 2: - Community dominated by *Artemisia brevifolia* I +

Table 3: - *Bistorta affinis* community-group I-II +-1

- Relevés in community of *Koeleria cristata* and *Stipa pennata* ssp. *kirghisorum* 1/1
- Relevés in transitional zone between subalpine steppe and *Bistorta affinis* community +/-

Hordeum brevisubulatum (Trin.) Link ssp. *nevskianum* (Bowd.) Tzvel.; 2576: Mulbekh, ca. 3250 m. H

Koeleria cristata (L.) Pers. (*K. macrantha* (Ledeb.) Schult. & Schult. f., *K. gracilis* Pers.); 2358: Sanmodangsa, Suru Vy., 3950 m, (Nr. 81); 2357: SW Dras, 3450 m, (Nr. 1); 2356: SE Matayan, Dras Vy., 3450 m, (Nr. 5); 5008: N Khardung La, 4440 m, (Nr. 282); 6056: between Sakti and Zingrul, Indus Vy., 4500 m, (Nr. 342). *Klim. & Srut.* (13. 9. 8): Zoji La, 3330 m; (31. 8. 89): Vy. of Bhaga River, Lahul, 3170 m. H

Table 2: - Community of *Koeleria cristata* / *Tanacetum artemisioides* IV 1-3

- Community dominated by *Artemisia brevifolia* I-III 1-3
- Community devoid of or with only sporadic *Artemisia brevifolia* IV +-4
- Community of *Artemisia wellbyi* / *Lindelofia anchlussoides* II 2
- Community of *Artemisia brevifolia* / *Tanacetum fruticosum* I r+

Table 3: - in nearly all subalpine turf and steppe-meadow communities III-V +-3

Table 4: - Community-group of *Potentilla bifurca* / *Artemisia gmelinii* II +-1

- *Aconogonon tortuosum*-*Nepeta glutinosa* community II +-1
- Community-group of *Elymus canaliculatus* and *Potentilla bifurca* I 1-4

Table 5: - *Caragana* community of the region of Matho Phu and Kanda La I 1

Table 6: - Community dominated by *Kobresia schoenoides* +

Leymus secalinus (Georgi) Tzvel.; 2337: S Matho, Indus Vy., 3790 m, (Nr. 56); 2565a: Tungri, Zanskar, 3600 m; 2564: end of Wakha Vy., SE Mulbekh, 3420 m, (Nr. 146); 2563: W Leh, ca. 3400 m; 3013: N Leh, 3600 m; 4094: Runtse, N of Taglang La, 4300 m; 5009: N Tso Kar, Rupshu, 4600 m; 6055: ca. 8 km E of Tsoltak, N Chang La, 4760 m, (Nr. 319). H,G

Table 2: - *Stachys tibetica* community II +

- Community dominated by *Artemisia brevifolia* I +
- Community of *Koeleria cristata* / *Tanacetum artemisioides* +

Table 4: - *Stipa purpurea*-*Carex moorcroftii* community V +-2

- Community-group of *Krascheninnikovia pungens* / *Ptilotrichum canescens* I-II +-3
- Community-group of *Potentilla bifurca* / *Artemisia gmelinii* I +

Table 6: - Incomplete species list (12) from the catchment area of Tso Moriri

Melica persica Kunth (*M. jacquemontii* Decne.); 2340: W Sanku, Suru Vy., 3820 m, (Nr. 60); 2556: Wakha Vy. SE Mulbekh, 3600 m; 2555: Yurutse, N Kanda La, 4180 m, (Nr. 144); 2557: Tungri, Zanskar, 3680 m, (Nr. 150). *Klim. & Srut.* (10. 9. 89): Fotu La, 3890 m; (12. 9. 89): Vy. of Dras, 2960 m. H

Table 2: - *Stachys tibetica* community III +-1

- Community of *Artemisia wellbyi* / *Lindelofia anchlussoides* I +
- Community of *Artemisia brevifolia* / *Tanacetum fruticosum* +
- Relevé in the low subalpine steppe-desert +

Pennisetum flaccidum Griseb.; 2574: N Leh, 3620 m; 3026: N Leh, 3650 m; 5010: above Sankar/Leh, 3580 m. H,G

Table 1: - Communities of the higher subalpine desert

Table 2: - Community of *Artemisia brevifolia* / *Tanacetum fruticosum* I +

Table 6: - Species list (12) from the catchment area of Tso Moriri

Pennisetum lanatum Klotzsch; *Klim. & Srut.* (31. 8. 89): Vy. of Bhaga River, Lahul, 3250 m. H,G

Phleum alpinum L.; *Klim. & Srut.* (13. 9. 89): Zoji La, 3330 m. H

Phragmites australis (Cav.) Trin. ex Steud.; 2575: Mulbekh, ca. 3200 m; 4121: Shey, Indus Vy., ca. 3300 m. G

Piptatherum gracile Mez; 2584: Dzongkhul Gompa, Zanskar, 3830 m, (Nr. 152); 2583a and b: Dzongkhul, Zanskar, 3800 m, (Nr. 151); 2342: W Sanku, Suru Vy., 3320 m, (Nr. 57); 3029: NE Yangtang, Indus Vy., 3720 m, (Nr. 183); 3030: Ang, Indus Vy., 3550 m, (Nr. 193); 3028: N Leh, ca. 3650 m; 4101: N Likir, Indus Vy., 4020 m, (Nr. 272); 4102: above Götsang Gompa / Hemis, 4300 m, (Nr. 225); 5011: N Khardung La, Shyok Vy., 4510 m, (Nr. 283). H

Table 1: - Communities of the higher subalpine desert II-V r-1

- Relevé within a transitional zone to the alpine belt N of Likir 1
- Relevé in a depression +

Table 2: - Community of *Artemisia brevifolia* / *Tanacetum fruticosum* V +-2

- Community devoid of or with only sporadic *Artemisia brevifolia* III 2-3
- Community of *Artemisia wellbyi* / *Lindelofia anchlussoides* III +-2
- Community dominated by *Artemisia brevifolia* I 2

Table 4: - Community-group of *Elymus canaliculatus* and *Potentilla bifurca* I-III +-1

- Community-group of *Potentilla bifurca* / *Artemisia gmelinii* III 1-3

Table 5: - *Caragana* community of the region of Matho Phu and Kanda La I 1

Piptatherum laterale (Munr.ex Regel)Roshev.; 2343: SW Dras, 3450 m, (Nr. 1); 2341: Sanmodangsa, Suru Vy., 3950 m, (Nr. 81); 2582: S Tungri, Zanskar, 4000 m, (Nr. 157); 2585: Pensi La, 4360 m, (Nr. 163).
K. Prach (31. 8. 89): Vy. of Bhaga River, Lahul, 3250 m. Klim. & Srut. (10. 9. 89): Fotu La, 3890 m. H

Table 2: - in nearly all communities of the subalpine steppe II-V r-2

Table 3: - *Artemisia brevifolia*-*Cicer microphyllum* community V 1-2

- Community-group of *Festuca kashmiriana* and *Poa suruana* III +-1

- *Bistorta affinis* community III +-1

- Community of *Koeleria cristata* and *Stipa pennata* ssp.kirghisorum V +-1

Table 4: - *Aconogonon tortuosum*-*Nepeta glutinosa* community IV +-1

Table 6: - Community of *Nepeta discolor* / *Festuca kashmiriana* IV +-2

Poa alpina L.; Klim. & Srut. (30. 8. 89): SW Darcha, Lahul, 3650 m. H

Poa attenuata Trin. (*P. araratica* auct., non Trautv., *P. koelzii* Bor, *P. lahulensis* Bor); 2378: SW Matho Phu, Indus Vy., 4470 m, (Nr. 44); 2379: Matho Phu, 4550 m, (Nr. 40); 2573: S Kanda La, 4880 m, (Nr. 135); 3039: Nimaling, Markha Vy., 5170 m, (Nr. 204); 3040: N Nimaling, 4800 m, (Nr. 206); 3041: Nimaling, 4860 m, (Nr. 201); 4103: Taglang La, 5310 m; 4109: NW Taglang La, 4950 m, (Nr. 231); 2568a: N Kanda La, 4850 m, (Nr. 137); 4104: Debring, Rupshu, 4820 m, (Nr. 252); 5003: N Khardung La, Shyok Vy., 4510 m, (Nr. 283); 5001a: Lachalung La, Rupshu, 5060 m; 5000: SE Khardung La, 5100 m, (Nr. 287); 6057: N Sankar /Leh, ca. 3600 m. H

Table 4: - Community-group of *Elymus canaliculatus* and *Potentilla bifurca* II +-2

- Community-group of *Krascheninnikovia pungens* / *Ptilotrichum canescens* +-II +

- Community-group of *Potentilla bifurca* / *Artemisia gmelinii* II +-2

- Community-group of *Elymus canaliculatus* and *Thermopsis inflata* / *Biebersteinia odora* I 1

Table 5: - in all communities I-V +-2

Table 6: - *Poa attenuata*-*Potentilla pamiirica* community-group IV-V +-3

- Relevé within *Carex* grassland (Rupshu) 1

- Incomplete species list (10) from Lachalung La (Rupshu)

Poa calliopsis Litw.ex Ovcz.; 3036: Tchatchutse, Markha Vy., 4380 m; 4106: Runtse, N Taglang La, 4300 m; 5005: N Tso Kar, Rupshu, 4600 m; 6058: Umla, Indus Vy., ca. 3850 m; 6059: W above Karzok, Tso Moriri, 4560 m. H,G

Table 6: - Incomplete species list (11) from the catchment area of Tso Moriri

Poa pratensis L.ssp. *pratensis* Dickoré; 2352: S Matayan, Dras Vy., 3550 m, (Nr. 4); 2353: Yasghun, Dras Vy., 3540 m, (Nr. 9); 2572a: N Kanda La, 4550 m, (Nr. 133); 2350: Matho Phu, Indus Vy., 4550 m, (Nr. 40); 3037: N Leh, ca. 3600 m; 4108: N Sankar /Leh, 3600 m. H,G

Table 3: - Community-group of *Festuca kashmiriana* and *Poa suruana* I +

- Relevés in community of *Koeleria cristata* and *Stipa pennata* ssp.kirghisorum 1/1

- Relevé in a transitional zone between subalpine steppe and *Bistorta affinis* community 1

- Relevé in grassland dominated by *Kobresia royleana* and *Leontopodium leontopodium* +

Poa pratensis L.ssp. *pruinosa* (Korotky)Dickoré (*P. markgrafii* H. Hartm., *P. jaunsarensis* Bor); 2380: W Panikhar, Suru Vy., 3640 m, (Nr. 102); 2351: Sanmodangsa, Suru Vy., 3880 m, (Nr. 100); 2570a: Pensi La, 4350 m; 2571: Stok Phu, Indus Vy., 4600 m. H,G

Table 2: - Community dominated by *Artemisia brevifolia* +

Table 3: - *Bistorta affinis* community I 1

- Relevé in grassland dominated by *Carex pseudofetida* 1

Table 5: - *Caragana* community of the region: Matho Phu and Kanda La IV +-1

Table 6: - *Poa attenuata*-*Potentilla pamiirica* community-group II 1-2

Poa sikkimensis (Stapf)Bor; 4107: NW Sankar /Leh, 3600 m; 6060: Umla, Indus Vy., 3850 m. T,H

Poa sterilis M.Bieb. (*P. araratica* auct. non Trautv.); 2346: S Matayan, Dras Vy., 3550 m, (Nr. 4); 2347: SE Matayan, 3450 m, (Nr. 5); 2349: SW Dras, 3450 m, (Nr. 1); 2348: E Kartse, Suru Vy., 4160 m, (Nr. 67); 2569a: Pensi La, 4360 m, (Nr. 161). Klim. & Srut. (30. 8. 89): SW Darcha, Lahul, 3650 m; (1. 9. 89): Vy. of Bhaga River, Lahul, 4160 m; (13. 9. 89): Zoji La, 3300 m. H

Table 1: - *Artemisia* steppe of a transitional zone to the alpine belt II 1

Table 2: - Community of *Koeleria cristata* / *Tanacetum artemisioides* III +-2

- Community dominated by *Artemisia brevifolia* II 1

- Community of *Artemisia brevifolia* / *Tanacetum fruticosum* +

- Community devoid of or with only sporadic *Artemisia brevifolia* I +

Table 3: - in most of the subalpine turf and steppe-meadow communities II-V +-2

Table 4: - in all steppe and semidesert communities of the alpine belt I-IV r-2

Table 5: - in nearly all communities I-III +-2

Table 6: - Community dominated by *Kobresia schoenoides* V +-3

- Community of *Nepeta discolor* / *Festuca kashmiriana* V +-3

- *Poa attenuata*-*Potentilla pamirica* community-group I +-1

Poa suruana Hartmann sp.nov.; 2873 (Typus): Sanmodangsa, Suru Vy., 3950 m; 2884: Vy. E of Kartse, Suru Vy., 3830 m, (Nr. 66). H

Table 3: - Community-group of *Festuca kashmiriana* and *Poa suruana* V +-3

- *Artemisia brevifolia*-*Cicer microphyllum* community IV +-2

- Grassland dominated by *Carex melanantha* IV +

- *Bistorta affinis* community I +

- - Relevé in grassland dominated by *Kobresia schoenoides* and *Agrostis vinealis* 1

Poa tibetica Munro ex Stapf; 3038: N Leh, ca. 3650 m; 5002: source vegetation N of Tso Kar, Rupshu, 4600 m; 6061: Umla, Indus Vy., 3850 m. H,G

Table 6: - Incomplete species list (12) from the catchment area of Tso Moriri

Polypogon monspeliensis (L.)Desf.; 2577: Mulbekh, ca. 3200 m; 4113: W Shey, Indus Vy., ca. 3300 m; 5014: S Matho, Indus Vy., 3650 m. T

Puccinellia himalaica Tzvel.; 4105: S Rumtse, N Taglang La, 4520 m, (Nr. 245); 4112: Rumtse, ca. 4300 m; 5001b: Lachalung La, Rupshu, 5060 m; 6062: NW coast of Pangong Tso, 4250 m. H

Table 5: - *Caragana* community of the region: Taglang La – Rupshu I +

Table 6: - - Relevé in moist grassland at a plain 1

Puccinellia ladakhensis (Hartmann)Dickoré comb.nov.; 2614: Stok Phu, Indus Vy., 4600 m; 5006: cf.: Lachalung La, Rupshu, 5060 m. H

Setaria viridis (L.)P.Beauv.; 5012: S Matho, Indus Vy., ca. 3650 m. T

Stipa breviflora Griseb.; 3035: Tchatchutse, Markha Vy., 4550 m, (Nr. 195); 4117: S Rumtse, N of Taglang La, 4560 m, (Nr. 230); 6071: ca. 8 km E of Tsoltak, N Chang La, 4710 m, (Nr. 320). H

Table 1: - Relevé within a transitional zone to the alpine belt 2

Table 4: - Community of *Stipa breviflora* / *Tanacetum fruticosum* V 1-2

- Community-group of *Krascheninnikovia pungens* / *Ptilotrichum canescens* V 1-3

- Community-group of *Potentilla bifurca* / *Artemisia gmelinii* +

- *Stipa glareosa*-*Krascheninnikovia pungens* community I 2

Table 5: - *Artemisia minor*-*Potentilla pamirica* community IV 1

Stipa caucasica Schmalh.ssp. *caucasica*; 2588: NE Leh, 3600 m, (Nr. 112); 5024c: W Khardung, Shyok Vy., 3890 m, (Nr. 285). H

Table 2: - Community of *Artemisia brevifolia* / *Tanacetum fruticosum* II +-1

Stipa caucasica Schmalh.ssp. *glareosa* (Smirn.)Tzvel.; 4114: between Debring and Tso Kar, Rupshu, 4700 m, (Nr. 255); 5026: NW Tso Kar, 4630 m, (Nr. 298); 6069: between Muglib and Pangong Tso, 4210 m, (Nr. 315); 6085: Kiagar La, Rupshu, 4800 m, (Nr. 331). H

Table 2: - Community of *Artemisia brevifolia* / *Tanacetum fruticosum* I 1

Table 4: - Community-group of *Krascheninnikovia pungens* / *Ptilotrichum canescens* III-V +-3

- *Stipa glareosa*-*Krascheninnikovia pungens* community V +-2

- Community-group of *Potentilla bifurca* / *Artemisia gmelinii* III r-1

- *Stipa purpurea*-*Carex moorcroftii* community I +

Table 5: - *Artemisia minor*-*Potentilla pamirica* community II +

Stipa himalaica Roshev.; 2381: S Matho, Indus Vy., 4030 m, (Nr. 54); 3032: NE Yangtang, Indus Vy., 3720 m, (Nr. 183); 4116: Sabu, E Leh, 3810 m, (Nr. 214); 6064: N of Sabu towards Digar Phu, 4170 m, (Nr. 312); 6066: N above Nang, Indus Vy., 4010 m, (Nr. 327). H

Table 1: - Communities of the higher subalpine desert III-IV r-2

- - Relevé within a transitional zone to the alpine belt N of Likir +

- - Relevé in a depression +

Table 2: - Community of *Artemisia brevifolia* / *Tanacetum fruticosum* II r-2

- *Stachys tibetica* community II 1

Stipa koelzii R.R.Stewart; 5028: Khardung, Shyok Vy., ca. 3800 m; 6067: N above Sankar /Leh, 3600 m; 6068: N Sankar above Leh, 3600 m. H

Stipa orientalis Trin.; 2382: S Mulbekh, 3570 m, (Nr. 12); 2587: N Kanda La, 4540 m, (Nr. 140); 3033: E Yangtang, Indus Vy., 3760 m, (Nr. 184); 3034: Ang, Indus Vy., 3550 m, (Nr. 194); 4115: Sabu, E of Leh, 3810 m, (Nr. 214); 5027: NE Gangles /Leh, 4290 m, (Nr. 292); 5024a: W Khardung, Shyok Vy., 3890 m, (Nr. 285); 6065: N Sabu towards Digar Phu, 4170 m, (Nr. 312); 6073: ca. 1 km E above Sakti, Indus Vy., 4320 m, (Nr. 343). H

Table 1: - in all communities of the subalpine desert II-IV r-2

- Table 2: - Community of *Koeleria cristata* / *Tanacetum artemisioides* III +-1
 - Community dominated by *Artemisia brevifolia* IV +-1
 - Community of *Artemisia brevifolia* / *Tanacetum fruticosum* IV +-2
 - Relevés in the low subalpine steppe-desert (W Ladakh) 2/+
- Table 4: - Community-group of *Krascheninnikovia pungens* / *Ptilotrichum canescens* II +-1
 - Community-group of *Elymus canaliculatus* and *Potentilla bifurca* +

Stipa pennata L.ssp. ***kirghisorum*** (Smirn.)H.Freitag; 2384: SE Matayan, Dras Vy., 3450 m, (Nr. 5); 2383: Sanmodangsa, Suru Vy., 3880 m, (Nr. 97); 2385: SW Dras, 3430 m, (Nr. 2). *Bill. & Léon. 6781*: near Kargil, 2950 m. H

- Table 2: - Community of *Koeleria cristata* / *Tanacetum artemisioides* II +
 Table 3: - Community of *Koeleria cristata* and *Stipa pennata* ssp.*kirghisorum* V 1-3
 - Community-group of *Festuca kashmiriana* and *Poa suruana* III +-1
 - *Artemisia brevifolia*-*Cicer microphyllum* community I +

Stipa purpurea Griseb.; 6070: Kiagar La, Rupshu, 4800 m, (Nr. 331). H

- Table 4: - *Stipa purpurea*-*Carex moorcroftii* community IV +-3

Stipa roborovskyi Roshev.; 6072: Kiagar La, Rupshu, 4800 m, (Nr. 331). H

- Table 4: - *Stipa purpurea*-*Carex moorcroftii* community V +-1
 - Community-group of *Potentilla bifurca* / *Artemisia gmelinii* +
 Table 6: - Incomplete species list (12) from the catchment area of Tso Moriri

Stipa splendens Trin.; 3042: Shingo, Markha Vy., ca. 4150 m; 4118: Shey, Indus Vy., 3300 m. H

Stipa subsessiliflora (Rupr.)Roshev.; 5025: NW Tso Kar, Rupshu, 4630 m, (Nr. 298). H

- Table 4: - Community-group of *Krascheninnikovia pungens* / *Ptilotrichum canescens* I +-1

Stipa tianschanica Roshev.; 5024b: W Khardung, Shyok Vy., 3890 m, (Nr. 285). H

- Table 2: - Community of *Artemisia brevifolia* / *Tanacetum fruticosum* I +

Trisetum spicatum (L.)Richt.ssp. ***himalaicum*** Hult.; 2345: W Matho Phu, Indus Vy., 4930 m, (Nr. 52); 2559: Pensi La, 4360 m, (Nr. 161); 3031: S Nimaling, Markha Vy., 4870 m, (Nr. 202); 4119: NE Taglang La, 5250 m, (Nr. 237); 4120: between Debring and Taglang La, Rupshu, 5050 m, (Nr. 261); 5013: S Khardung La, 4950 m. *Klim. & Srut.* (30. 8. 89): SW Darcha, Lahul, 3650 m; (1. 9. 89): Vy. of Bhaga River, Lahul, 4520 m. H

- Table 4: - Community-group of *Potentilla bifurca* / *Artemisia gmelinii* +
 Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group I-IV +-2
 - Community dominated by *Kobresia schoenoides* V +-2
 - Community of *Nepeta discolor* / *Festuca kashmiriana* I +

Polygonaceae

Aconogonon rumicifolium (Royle)Hara (*Polygonum rumicifolium* Royle ex Bab.); 2138: S Matayan, Dras Vy., 3550 m, (Nr. 4); 2755: Pensi La, 4370 m, (Nr. 178); 2754: Parkutse, Suru Vy., ca. 3450 m. H,G

- Table 3: - Relevé in community of *Koeleria cristata* and *Stipa pennata* ssp.*kirghisorum* +
 Table 6: - Community of *Nepeta discolor* / *Festuca kashmiriana* I +

Aconogonon sibiricum Laxm.ssp. ***thomsonii*** (Meissn.ex St.)Rech.f.et Sch.-Cz.; 2750: Stok Phu, Indus Vy., 4500 m; 4159: Debring, Rupshu, 4830 m, (Nr. 268); 5068: N Tso Kar, Rupshu, 4600 m; 6045: NW littoral zone of Pangong Tso, 4250 m. H,G

- Table 6: - Relevé within *Carex* grassland (Rupshu) 1
 - Relevé in moist grassland at a plain +
 - Species list (12) from the catchment area of Tso Moriri

Aconogonon tortuosum (D.Don)Hara (*Polygonum tortuosum* D.Don); 2139: Alchi Brok, Indus Vy., 4160 m, (Nr. 34); 2140: Sanmodangsa, Suru Vy., 4340 m, (Nr. 89). *Moh. Deen* (11. 8. 92): Sapi, W-Ladakh. H,Ch

- Table 2: - Community of *Artemisia wellbyi* / *Lindelofia anchusoides* III r-1
 - *Stachys tibetica* community +-II +
 - Relevé of the *Koeleria cristata* community +
 Table 3: - *Artemisia brevifolia*-*Cicer microphyllum* community IV 2-4
 - Grassland dominated by *Carex melanantha* IV +
 - Community-group of *Festuca kashmiriana* and *Poa suruana* II +
 Table 4: - *Aconogonon tortuosum*-*Nepeta glutinosa* community V +-4
 - Community-group of *Elymus canaliculatus* and *Thermopsis inflata* / *Biebersteinia odora* III +-3
 - Community-group of *Krascheninnikovia pungens* / *Ptilotrichum canescens* I r-+

- *Stipa purpurea*-*Carex moorcroftii* community I +
- Relevé in a succession stage of *Artemisia wellbyi* 2

Table 5: - *Caragana* community of the region of Matho Phu and Kanda La I +

Bistorta affinis (D.Don)Greene (*Polygonum affine* D.Don); 2130: E Yasghun, Dras Vy., 3540 m, (Nr. 9); 2131: Vy. E of Kartse, Suru Vy., 3830 m, (Nr. 66). *Klim. & Srut.* (30. 8. 89): SW Darcha, Lahul, 3650 m. Ch

- Table 2: - Community dominated by *Artemisia brevifolia* II +3
- Community of *Koeleria cristata* / *Tanacetum artemisioides* +
 - Community of *Artemisia wellbyi* / *Lindelofia anchlussoides* +

- Table 3: - *Bistorta affinis* community-group V +5
- *Artemisia brevifolia*-*Cicer microphyllum* community I +
 - Relevés in community-group of *Festuca kashmiriana* and *Poa suruana* +/3

- Table 6: - Community of *Nepeta discolor* / *Festuca kashmiriana* IV +-1
- Community dominated by *Kobresia schoenoides* +

Bistorta vivipara (L.)S.F.Gray (*Polygonum viviparum* L.); 3108: Nimaling, Markha Vy., 4750 m; 4154: S Rumtse, N Taglang La, 4500 m, (Nr. 245). H

- Table 3: - Relevés in grassland dominated by *Kobresia royleana* and *Leontopodium leontopodium* 2/+

- Table 6: - *Poa attenuata*-*Potentilla pamiica* community-group +-II +-2

- Relevé in moist grassland at a plain +
- Relevé within higher *Kobresia* grassland 2
- Relevé within *Carex* grassland (Rupshu) 2
- Incomplete species lists (10, 11) from Lachalung La and from the catchment area of Tso Moriri

Fagopyrum tataricum (L.)Gaertn.; 2746: Shagar E Tungri, Zanskar, ca. 3600 m; 3106: N Leh, 3600 m. T

Koenigia islandica L.; 2756: N Kanda La, 4520 m; 4162: NW Leh, ca. 3720 m; 5030: Tisseru /Leh, 3600 m; 5069: Nie N of Basgo, Indus Vy., 3780 m; 5070: N Tso Kar, Rupshu, 4600 m. T

Oxyria digyna (L.)Hill; 3103: Ang, Indus Vy., ca. 3600 m. H,(G)

Persicaria lapathifolia (L.)S.F.Gray (*Polygonum lapathifolium* L.); 5067: S Matho, Indus Vy., 3700 m. T

Persicaria maculosa S.F.Gray (*Polygonum persicaria* L.); not collected, but common in many cereal-fields (1987!). T

Persicaria nepalensis (Meissn.)H.Gross; 3104: Tingsmogang, Indus Vy., ca. 3300 m. T

Polygonum aviculare L.; 3107: below Tingsmogang, Indus Vy., ca. 3350 m. T

Polygonum cognatum Meissn. (*P. rupestre* Kar. et Kir.); 2132: SE Matayan, Dras Vy., 3450 m, (Nr. 5); 2753: Pensi La, 4360 m, (Nr. 163); 2752: Dzongkhul Gompa, Zanskar, 3800 m, (Nr. 151); 4160: Debring, Rupshu, 4950 m, (Nr. 267). G,(H)

- Table 2: - Community dominated by *Artemisia brevifolia* +
- Community of *Artemisia wellbyi* / *Lindelofia anchlussoides* +

- Table 3: - Community of *Koeleria cristata* and *Stipa pennata* ssp.kirghisorum V +-1
- Community-group of *Festuca kashmiriana* and *Poa suruana* I +
 - Community-group of *Potentilla bifurca* / *Artemisia gmelinii* +

- Table 6: - Community of *Nepeta discolor* / *Festuca kashmiriana* III +-1
- Community dominated by *Kobresia schoenoides* +
 - *Poa attenuata*-*Potentilla pamiica* community-group +-II r-+

Polygonum molliaeforme Boiss.; 2747: E Kanda La, 4520 m; 4158: Debring, Rupshu, 4820 m, (Nr. 252). T

- Table 4: - Community-group of *Krascheninnikovia pungens* / *Ptilotrichum canescens* II +-3
- Community-group of *Potentilla bifurca* / *Artemisia gmelinii* I +-2

- Table 5: - *Caragana* community of the region of Taglang La – Rupshu II 1-2
- *Poa attenuata*-*Potentilla pamiica* community-group +

Polygonum paronychioides C.A.Mey.ex Hohen.; 2135: SW Dras, 3450 m, (Nr. 1); 2133: Sanmodangsa, Suru Vy., 3950 m, (Nr. 81); 2134: NW Fotu La, 4190 m, (Nr. 25). Ch

- Table 1: - Communities of the higher subalpine desert I +-1

- Table 2: - in nearly all communities of the subalpine steppe II-V r-2

- Table 3: - *Artemisia brevifolia*-*Cicer microphyllum* community V +-1
- Community-group of *Festuca kashmiriana* and *Poa suruana* III +-1
 - *Bistorta affinis* community-group I +
 - Relevé in community of *Koeleria cristata* and *Stipa pennata* ssp.kirghisorum 1

Polygonum polycnemoides Jaub.et Spach (*P. olivieri* Jaub.et Spach); 2136: SE Matayan, Dras Vy., 3450 m, (Nr. 5); 2137: W Sanku, Suru Vy., 3320 m, (Nr. 57); 3105: W Sabu, Indus Vy., 3400 m; 4157: 26 km W of Leh, 3550 m, (Nr. 279). *Klim. & Srut.* (31. 8. 89): Vy. of Bhaga River, Lahul, 3170 m; (13. 9. 89): Zoji La, 3330 m. T

Table 3: - *Bistorta affinis* community-group IV +-2

- *Artemisia brevifolia*-*Cicer microphyllum* community III +-2
- Community-group of *Festuca kashmiriana* and *Poa suruana* IV +-2
- Community of *Koeleria cristata* and *Stipa pennata* ssp.*kirghisorum* IV 1-2
- - Relevé in grassland dominated by *Carex pseudofoetida* 2

Polygonum rothboellioides Jaub.et Spach (*P. tubulosum* Boiss.); 2748: S Leh, ca. 3450 m; 2749: Tungri, Zanskar, 3640 m, (Nr. 149); 4163: NE Spituk, Indus Vy., 3380 m, (Nr. 215). T

Polygonum rothboellioides* / *polycnemoides

Table 1: - Communities of the higher subalpine desert +

- - Relevé in a depression 1
- - Relevé from a stand with additional water supply 2

Table 2: - in nearly all subalpine steppe communities II-V +-2

Table 4: - Community-group of *Potentilla bifurca* / *Artemisia gmelinii* II +

Rheum spiciforme Royle; not collected but observed in Rupshu at several places between More Plain and Lachalung La, 4500 m – ca. 4850 m (23. 8. – 27. 8. 1995). G

Table 5: - *Caragana* community of the region of Taglang La – Rupshu II r+

Rheum tibeticum Maxim.; 2141: Alchi Brok, Indus Vy., 4300 m, (Nr. 33). G

Table 1: - Communities of the higher subalpine desert +

Table 4: - *Aconogonon tortuosum*-*Nepeta glutinosa* community IV r+

- Community-group of *Elymus canaliculatus* and *Thermopsis inflata* / *Biebersteinia odora* I +
- Community-group of *Elymus canaliculatus* and *Potentilla bifurca* +

Rheum webbianum Royle; 2142: S Matayan, Dras Vy., 3550 m, (Nr. 4); 2143: Sanmodangsa, Suru Vy., 4040 m, (Nr. 82). G

Table 2: - Community dominated by *Artemisia brevifolia* +

- Community of *Artemisia wellbyi* / *Lindelofia anchusoides* +

Table 3: - Grassland dominated by *Carex melanantha* V +

- *Artemisia brevifolia*-*Cicer microphyllum* community III +
- Community-group of *Festuca kashmiriana* and *Poa suruana* III +
- Community of *Koeleria cristata* and *Stipa pennata* ssp.*kirghisorum* IV +
- - Relevé in grassland dominated by *Kobresia schoenoides* and *Agrostis vinealis* r

Table 6: - Community of *Nepeta discolor* / *Festuca kashmiriana* I +

Rumex acetosa L.; 2144: N Sanmodangsa, Suru Vy., 3980 m, (Nr. 91). H

Table 3: - Community-group of *Festuca kashmiriana* and *Poa suruana* I +

- - Relevé in grassland dominated by *Kobresia schoenoides* and *Agrostis vinealis* l

Rumex angulatus Rech.f.; 2743: Mulbekh, 3170 m; 4164: Shey, Indus Vy., 3300 m. H

Rumex patientia L. ssp. *tibeticus* Rech.f.; 2744: Mulbekh, 3170 m; 4161: NW Leh, ca. 3610 m. H

Potamogetonaceae

Potamogeton pectinatus L.; 4165: below Shey, Indus Vy., 3300 m. A

Potamogeton perfoliatus L.; 4166: below Shey, Indus Vy., 3300 m. A

Primulaceae

Androsace aizoon Duby var. *himalaica* Kunth; 2281: SE Matayan, Dras Vy., 3370 m, (Nr. 6). Ch

Table 3: - Relevé in community of *Koeleria cristata* and *Stipa pennata* ssp.*kirghisorum* +

Androsace mucronifolia Watt (*A. microphylla* Hook.f.); 2786: Zoji La, 3800 m. Ch

Androsace primuloides Duby; 2783: Zoji La, 3700 m. Ch

Androsace robusta (Kunth)Hand.-Mazz.ssp. *robusta* Y.Nasir; 2280: S Mulbekh, 3740 m, (Nr. 10); 2787: E Kanda La, 4560 m, (Nr. 142); 5071: Norbo, More Plain, 4860 m, (Nr. 309). *Bill. & Léon. 6873*: Tirdik, N Sa-bu, Indus Vy., 4800 m. *Klim. & Srut.* (10. 9. 89): Fotu La, 3920 m. Ch

Table 1: - Relevé within a transitional zone to the alpine belt N of Likir 2

Table 2: - Community of *Koeleria cristata* / *Tanacetum artemisioides* III r-2

- Community of *Artemisia brevifolia* / *Tanacetum fruticosum* II +-1
- Community dominated by *Artemisia brevifolia* I r-1
- - Relevé of the *Koeleria cristata* community +

Table 3: - *Bistorta affinis* community-group III-V +-2

Table 4: - *Aconogonon tortuosum*-*Nepeta glutinosa* community II +

- Community-group of *Elymus canaliculatus* and *Potentilla bifurca* +I +
- Community of *Stipa breviflora* / *Tanacetum fruticosum* I +
- Community-group of *Potentilla bifurca* / *Artemisia gmelinii* I +1

Androsace* cf. *robusta

Table 5: - *Caragana* community of the region: Taglang La – Rupshu II 1

Androsace rotundifolia Hardw.; *Bill. & Léon. 6768*: between Zoji La and Dras, 3350 m. *Klim. & Srut.* (13. 9. 89): Zoji La, 3330 m. H

Androsace septentrionalis L.; *2279*: Matho Phu, Indus Vy., 4900 m, (Nr. 51); *2781*: Stok Phu, Indus Vy., 4700 m, (Nr. 126); *3186*: Nimaling, Markha Vy., 4960 m, (Nr. 208). T

Table 4: - Community-group of *Potentilla bifurca* / *Artemisia gmelinii* +

Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group +II +

Glaux maritima L.; *4044*: S Rumtse, N Taglang La, 4500 m; *4046*: Sabu, Indus Vy., 3820 m; *6044*: Muglib, Camping ground about 15 km W of Pangong Tso, 4120 m. H,G

Table 6: - Relevé in moist grassland at a plain 2

- Incomplete species list (12) from the catchment area of Tso Moriri

Primula denticulata Smith; *2276*: Sanmodangsa, Suru Vy., 4050 m, (Nr. 93). H

Table 3: - Relevé in grassland dominated by *Kobresia schoenoides* and *Agrostis vinealis* 1

Primula elliptica Royle; *2278*: Yasghun, Dras Vy., 3540 m, (Nr. 9); *2277*: Vy. E of Kartse, Suru Vy., 4160 m, (Nr. 67). *Bill. & Léon. 6858*: Tirdik, N Sabu, Indus Vy., 4800 m. H

Table 2: - Community dominated by *Artemisia brevifolia* I +

Table 3: - *Bistorta affinis* community-group II-V +1

- - Relevés in a transitional zone between subalpine steppe and *Bistorta affinis* community +/-

Primula macrophylla D.Don (*P. nivalis* var. *moorcroftiana* (Wall.)Pax, *P. nivalis* var. *macrophylla* Pax); *4168*: NW Taglang La, 5250 m. H

Primula minutissima Jacq.; *2788*: Pensi La, 4360 m, (Nr. 161). *Klim. & Srut.* (1. 9. 89): Vy. of Bhaga River, Lahul, 4520 m. H

Table 6: - Community dominated by *Kobresia schoenoides* III +1

Primula nutans J.G.Georgi; *4167*: S Rumtse, N of Taglang La, 4500 m, (Nr. 245). H

Table 6: - Relevé in moist grassland at a plain +

Pyrolaceae

Pyrola rotundifolia L.ssp. *karakoramica* Krisa; *2792*: Wakha Vy., SE Mulbekh, 3650 m. H

Ranunculaceae

Aconitum chasmanthum Stapf ex Holmes (*A. napellus* sensu Hook.f.et Th.); *3110*: Dras, 3200 m. H

Aconitum violaceum Jacquem.ex Stapf; *2147*: W Sanmodangsa, Suru Vy., 4190 m, (Nr. 86); *2666*: Pensi La, 4360 m; *4172*: Rohtang Pass, Lahul, ca. 4000 m. H

Table 3: - Grassland dominated by *Carex melanantha* IV 1

- - Relevé in grassland dominated by *Kobresia schoenoides* and *Agrostis vinealis* 2

Anemone obtusiloba D.Don; *4171*: Rohtang Pass, Lahul, ca. 4000 m. H

Anemone rivularis Buch.-Ham.ex DC.; *3122*: Yangtang, Indus Vy., ca. 3600 m. H

Aquilegia fragrans Benth.; *2145*: Matayan, Dras Vy., 3420 m; *6827*: below Götsang Gompa, Indus Vy., 3900 – 4000 m. H

Aquilegia moorcroftiana Wall.ex Royle; *2146*: Alchi Brok, Indus Vy., 3900 m; *2650*: W Rumbak, S Indus Vy. ca. 4000 m; *2649*: Wakha Vy., SE of Mulbekh, ca. 3700 m. H

Clematis orientalis L.var. *acutifolia* Hook.f.; *2664*: W Rumbak, S Indus Vy., ca. 4100 m; *2150*: Leh, 3500 m; *3111*: W Markha, ca. 3850 m; *5073*: N Tisseru /Leh, 3650 m; *6074*: about 5 km W of Pangong Tso, 4300 m. *K. Prach* (4. 9. 89): Upshi, Indus Vy., 3350 m. NP

Delphinium brunonianum Royle; *2151*: S Alchi Brok, Indus Vy., 4500 m; *2652*: Pensi La, 4460 m, (Nr. 166); *3113*: S Kongmaru La, Nimaling, 5100 m, (Nr. 212). H

Table 4: - Community-group of *Elymus canaliculatus* and *Thermopsis inflata* / *Biebersteinia odora* II r+ +

- *Aconogonon tortuosum*-*Nepeta glutinosa* community +

Table 6: - Community of *Nepeta discolor* / *Festuca kashmiriana* II +
- *Poa attenuata*-*Potentilla pamirica* community-group +-II +

Delphinium cashmerianum Royle; 2153: Panikhar, Suru Vy., 3300 m; 2152: E of Kartse, Suru Vy., 4160 m, (Nr. 67);
2651: Pensi La, ca. 4430 m. H

Table 3: - *Bistorta affinis* community-group IV +-1

Table 6: - Community of *Nepeta discolor* / *Festuca kashmiriana* I +

Paraquilegia anemonoides (Willd.)Ulbr. (*Isopyrum grandiflorum* Fisch.ex DC.); 2661: E Stok La, 4750 m. H

Pulsatilla wallichiana (Royle)Ulbr. (*Anemone wallichiana* Royle, *A. albana* Hook.f.et Th.); 2148: S Yasghun, Dras Vy., 3540 m, (Nr. 9); 2149: E Kartse, Suru Vy., 4160 m, (Nr. 67). *Bill. & Léon. 6860*: Tirdik, N of Sabu, Indus Vy., 4800 m. H

Table 2: - Community dominated by *Artemisia brevifolia* I +-2

Table 3: - *Bistorta affinis* community-group IV +-2

- Transitional zone between subalpine steppe and *Bistorta affinis* community +/-

Ranunculus bikramii Aswal et Mehrotra; 4170: Rohtang Pass, Lahul, ca. 4000 m. H

Ranunculus brotherusii Freyn.; 2156: Leh, 3500 m; 3117: Tchatchutse, Markha Vy., 4400 m; 3116: N of Leh, ca. 3600 m; 3115: Yangtang, Indus Vy., ca. 3600 m. H

Ranunculus lobatus Jacq.ex Camb.; 2154: Matho Phu, Indus Vy., 4930 m, (Nr. 52); 2676: Stok Phu, Indus Vy., 4740 m, (Nr. 127); 2672: S Stok Phu, 4650 m; 3120: Nimaling, Markha Vy., 4860 m, (Nr. 201); 3119: S Kongmaru La, Nimaling, 5100 m, (Nr. 212). H

Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group I-III +-1

Ranunculus* cf. *membranaceus Royle; 2674: N Kanda La, 4890 m, (Nr. 136); 3121: Nimaling, Markha Vy., 4860 m, (Nr. 201). H

Ranunculus munroanus J.R.Drumm.; 2679: Zoji La, 3700 m. H

Ranunculus pulchellus C.A.Mey.; 2675: S Stok, Indus Vy., 3700 m; 4182: NW Taglang La, 5200 m, (Nr. 239). H

Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group +

- - Relevé within higher *Kobresia* grassland r

Ranunculus pulchellus* var. *stracheyanus (Max.)Hand.-Mazz.; 2673: S Kanda La, 4880 m, (Nr. 135); 3118: Nimaling, Markha Vy., 4860 m, (Nr. 201). H

Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group +-I +

- - Relevé in moist grassland at a plain 2

- - Relevé within *Carex* grassland (Rupshu) +

Ranunculus tricuspis Maxim.var. ***lancifolius*** (Bertol.)Hara; 2155: Matho Phu, Indus Vy., 4400 m; 2677: S Stok, Indus Vy., 4000 m; 3114: N Leh, ca. 3650 m; 4173: S Runtse, S of Indus Vy., ca. 4500 m; 5072a: S Matho, Indus Vy., ca. 3650 m; 5072b: S Matho, ca. 3650 m; 6075: W above Karzok, Tso Moriri, 4560 m, edge of the last barley field. H

Table 6: - Incomplete species lists (11, 12) from the catchment area of Tso Moriri

Thalictrum alpinum L.var. ***microphyllum*** (Royle)Hand.-Mazz.; 2658: Stok Phu, Indus Vy., 4740 m, (Nr. 127); 2657: Pensi La, 4360 m, (Nr. 161); 3124: Nimaling, Markha Vy., 4860 m, (Nr. 201). H

Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group I-III +-2

- Community dominated by *Kobresia schoenoides* III +-2

- - Relevé within higher *Kobresia* grassland +

- - Species list (11) from the catchment area of Tso Moriri

Thalictrum foetidum L. (*T. vaginatum* Royle ?); 2157: E Kartse, Suru Vy., 4060 m, (Nr. 69); 2158: S Yasghun, Dras Vy., 3540 m, (Nr. 9); 2159: W Panikhar, Suru Vy., 3660 m, (Nr. 103); 3123: N Leh, ca. 3650 m. H

Table 2: - Community dominated by *Artemisia brevifolia* II +

- *Stachys tibetica* community I +

Table 3: - *Bistorta affinis* community-group II +

Table 4: - *Aconogonon tortuosum*-*Nepeta glutinosa* community I +

Rhamnaceae

Rhamnus prostrata Jacquem.ex Park; 2793: N Tungri, Zaskar, ca. 3750 m. *Bill. & Léon. 6839*: between Götsang Gompa and Hemis, 4000 m. NP

Rosaceae

Chamaerhodos sabulosa Bunge; 5076: S Tso Kar, Rupshu, 4670 m, (Nr. 301); 6046: N above Nang, Indus Vy., 4010 m, (Nr. 327); 6047: Kiagar La, Rupshu, 4800 m, (Nr. 331). H

Table 2: - Community of *Artemisia brevifolia* / *Tanacetum fruticosum* I +

Table 4: - Community-group of *Krascheninnikovia pungens* / *Ptilotrichum canescens* +
- *Stipa purpurea*-*Carex moorcroftii* community II r-1

Cotoneaster uniflora Bunge; 2250: Sanmodangsa, Suru Vy., 3910 m, (Nr. 85). NP

Table 3: - *Artemisia brevifolia*-*Cicer microphyllum* community I 1

Dasiphora dryadanthoides Juz. (*Potentilla fruticosa* L. var. *pumila* Hook.f.); 2241: Alchi Brok, Indus Vy., 4460 m, (Nr. 37); 2863: S Stok Phu, Indus Vy., 4600 m. Ch

Table 4: - Relevé in *Aconogonon tortuosum*-*Nepeta glutinosa* community +

Table 6: - *Poa attenuata*-*Potentilla pamiirica* community-group +-II +-2
- Community of *Nepeta discolor* / *Festuca kashmiriana* I r

Fragaria nubicola Lindl.; 2870: Zoji La, 3700 m. H

Geum elatum G. Don (*Sieversia elata* Royle); 4178: Rohtang Pass, Lahul, ca. 4000 m. H

Potentilla ambigua Camb.; 2853: E of Stok La, Indus Vy., 4700 m. H,(G)

Table 4: - Community-group of *Elymus canaliculatus* and *Thermopsis inflata* / *Biebersteinia odora* I +

Potentilla anserina L.; 2868: N Leh, 3560 m; 3084: N Leh, ca. 3650 m. H

Potentilla aphanes Soják in Willd. (*P. sericea* L. var. *dasyphylla* Ledeb. ?); 2246: Matho Phu, Indus Vy., 4700 m, (Nr. 49). H

Table 4: - Community-group of *Elymus canaliculatus* and *Potentilla bifurca* I +

Potentilla argyrophylla Wall. var. *leucochroa* (Lindl.) Hook.f.; 2236: SW Sanku, Suru Vy., 3460 m, (Nr. 58); 2866: Zoji La, 3700 m; 2867: Pensi La, 4360 m, (Nr. 161). Bill. & Léon. 6862: Tirdik N Sabu, Indus Vy., 4800 m. Klim. & Srut. (12. 9. 89): E of Dras, 2930 m. H

Table 2: - Community devoid of or with only sporadic *Artemisia brevifolia* I +

Table 3: - Relevé in transitional zone between subalpine steppe and *Bistorta affinis* community-group +
- Relevé in grassland dominated by *Kobresia royleana* and *Leontopodium leontopodium* +

Table 4: - Community-group of *Potentilla bifurca* / *Artemisia gmelinii* +

Table 6: - Community dominated by *Kobresia schoenoides* IV +-2
- Community of *Nepeta discolor* / *Festuca kashmiriana* III +-2
- *Poa attenuata*-*Potentilla pamiirica* community-group I +

Potentilla atosanguinea Lodd.; 4174: S Rohtang Pass, Lahul, 3600 m. H

Potentilla bifurca L.; 2238: Alchi Brok, Indus Vy., 4460 m, (Nr. 37); 2237: W Sanku, Suru Vy., 3320 m, (Nr. 57); 3085: f. *monstrosa*: between Yangtang and Sermanchan La, 3750 m. H,(G)

Table 1: - *Artemisia* steppe of a transitional zone to the alpine belt II +
- Relevé within a transitional zone to the alpine belt in SE 1

Table 2: - Community of *Artemisia brevifolia* / *Tanacetum fruticosum* III r-1
- *Stachys tibetica* community II +

- Community devoid of or with only sporadic *Artemisia brevifolia* I 2
- Relevé of the *Koeleria cristata* community +

- Relevé within a transitional zone to the alpine belt on Fotu La +

Table 3: - Relevé in grassland dominated by *Carex pseudofoetida* 2

Table 4: - in nearly all steppe and semidesert communities of the alpine belt I-V +-2

Table 5: - in all *Caragana versicolor* communities and in the *Artemisia minor*-*Potentilla pamiirica* steppe II-IV +-2

Table 6: - *Poa attenuata*-*Potentilla pamiirica* community-group +-III +-3
- Relevé in *Carex* grassland (Rupshu) 2
- Species list (12) from the catchment area of Tso Moriri

Potentilla desertorum Bunge (*P. arnavatensis* (Th. Wolf) Th. Wolf ex Juz.); 2864: Pensi La, 4380 m, (Nr. 162); 2240: SE Matayan, Vy. of Dras, 3370 m, (Nr. 6); 2239: Yasghun, Vy. of Dras, 3540 m, (Nr. 9). H

Table 3: - Relevé in community of *Koeleria cristata* and *Stipa pennata* ssp. *kirghisorum* +

- Relevé in a transitional zone between subalpine steppe and *Bistorta affinis* community +

Table 6: - Community of *Nepeta discolor* / *Festuca kashmiriana* II +
- Community dominated by *Kobresia schoenoides* I +

Potentilla gelida C.A. Mey.; 2242: W Matho Phu, Indus Vy., 4900 m, (Nr. 51); 5074: N of Khardung La, ca. 5150 m. H

Potentilla gelida* inclus. var. *turczaninowiana

Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group II-IV +-1
- Community dominated by *Kobresia schoenoides* II +-2
- Community of *Nepeta discolor* / *Festuca kashmiriana* II +

Potentilla gelida* C.A.Mey. var. *turczaninowiana Th. Wolf; 2862: Stok Phu, Indus Vy., 4740 m, (Nr. 127). H

Potentilla gelida* cf. var. *genuina Th. Wolf; 2861: Pensi La, 4360 m. H

***Potentilla multifida* L.**; 2243: S Matho Phu, Indus Vy., 4550 m, (Nr. 40); 2859: N of Kanda La, 4550 m; 2860: Pensi La, 4350 m; 3086: Yangtang, Indus Vy., ca. 3600 m; 3087: Nimaling, Markha Vy., 4750 m. H

Table 3: - Relevé in grassland dominated by *Kobresia royleana* and *Leontopodium leontopodium* r

Table 5: - *Caragana* community of the region of Taglang La – Rupshu as well as Kanda La and Matho Phu III-IV +-1

Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group III 1-3
- Community dominated by *Kobresia schoenoides* +
- Relevé in *Carex* grassland (Rupshu) 2
- Incomplete species lists (11, 12) from the catchment area of Tso Moriri

Potentilla nivea* L. cf. var. *himalaica Kitam.; 2244: W Matho Phu, Indus Vy., 4930 m, (Nr. 52); 6048: S above Tsoltak, N Chang La, 5150 m, (Nr. 326). H

Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group II +

Potentilla salesoviana Steph.; 2245: Alchi Brok, Indus Vy., 4000 m; 2857: middle of Wakha Vy., SE Mulbekh, 3650 m; 3088: between Kongmaru La and Shang, Indus Vy., 4400 m. Ch

Table 2: - Relevé in the *Stachys tibetica* community +

Potentilla pamirica Wolf.; 2248: Alchi Brok, Indus Vy., 4460 m, (Nr. 37); 2249: Matho Phu, Indus Vy., 4930 m, (Nr. 52); 2247: SW Matho Phu, Indus Vy., 4470 m, (Nr. 44); 2856: Stok Phu, Indus Vy., 4700 m, (Nr. 126); 3089: S Kongmaru La, Nimaling, 5100 m; 4176: Taglang La, 5310 m. H₁(Ch)

Table 5: - *Artemisia minor*-*Potentilla pamirica* community-group V +-2
- *Caragana* community of the region of Taglang La – Rupshu III +-1
- Relevé in the *Caragana* community at the valley of Nimaling +

Potentilla pamirica Wolf (inclus. *P. aphanes* Sojak)

Table 4: - Community of *Stipa brevifolia* / *Tanacetum fruticosum* III +
- Community-group of *Potentilla bifurca* / *Artemisia gmelinii* II +-3
- Community-group of *Elymus canaliculatus* and *Potentilla bifurca* II +-1
- Community-group of *Krascheninnikovia pungens* / *Ptilotrichum canescens* +
- Relevé in *Aconogonon tortuosum*-*Nepeta glutinosa* community +

Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group IV-V 1-4
- Community of *Nepeta discolor* / *Festuca kashmiriana* I +
- Relevé within higher *Kobresia* grassland 2
- Relevé within *Carex* grassland (Rupshu) +
- Incomplete species list (10) from Lachalung La (Rupshu)

Potentilla sp.; 4175: NW Taglang La, 5250 m, (Nr. 237). H₁(Ch)

Rosa eglanteria in FBI, 2: 366; Bill. & Léon. 6896: Dras, 3100 m. NP

Rosa webbiana Wall.ex Royle; 2252: SW Dras, 3430 m, (Nr. 3); 2251: Matayan, Dras Vy., ca. 3420 m. Bill. & Léon. 6786: near Kargil, 2950 m. NP

Table 1: - *Artemisia* steppe of a transitional zone to the alpine belt IV r
- Communities of the higher subalpine belt r +

Table 2: - Community of *Artemisia wellbyi* / *Lindelofia anchusoides* II r+
- Community of *Koeleria cristata* / *Tanacetum artemisioides* +
- Community of *Artemisia brevifolia* / *Tanacetum fruticosum* +

Table 3: - Relevé in community of *Koeleria cristata* and *Stipa pennata* ssp. *kirghisorum* +

Sibbaldia cuneata (Wall.)Hornem.ex Kuntze (*S. parviflora* Kitam.); 2253: W Sanku, Suru Vy., 4030 m, (Nr. 63); 2254: W Panikhar, Suru Vy., 3640 m, (Nr. 102); 2855: Pensi La, 4370 m, (Nr. 165). H₁(Ch)

Table 3: - Relevé in grassland dominated by *Carex pseudofoetida* 2
- Relevé in grassland dominated by *Kobresia royleana* and *Leontopodium leontopodium* +

Table 6: - Community dominated by *Kobresia schoenoides* III +-2

Sibbaldia cuneata (Wall.)Hornem.ex Kuntze var. *micrantha* (Hook.f.)R.R.Stew.; 5075: N Khardung La, Shyok Vy., 4440 m, (Nr. 282). H₁(Ch)

Table 4: - Community-group of *Potentilla bifurca* / *Artemisia gmelinii* +

Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group II-III +-1

Sibbaldia tetrandra Bunge (*Potentilla tetrandra* (Bunge) Juz.); 2852: Stok Phu, Indus Vy., 4740 m, (Nr. 127); 4177: NW Taglang La, 5250 m, (Nr. 237); 3090: Nimaling, Markha Vy., 4860 m, (Nr. 201). Ch

Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group +-II +-1

- - Incomplete species list (10) from Lachalung La (Rupshu)

Rubiaceae

Galium boreale L.; 2015: SE Matayan, Dras Vy., 3450 m, (Nr. 5). *Klim. & Srut.* (13. 9. 89): Zoji La, 3330 m. H,G

Table 3: - Relevés in community of *Koeleria cristata* and *Stipa pennata* ssp. *kirghisorum* 1/1

- Relevé in a transitional zone between subalpine steppe and *Bistorta affinis* community +

Galium pauciflorum Bunge; 6076: Umla, Indus Vy., ca. 3850 m. T

Galium verum L.; 2016: W Sanku, Suru Vy., 3480 m, (Nr. 59); 2017: SW Dras, 3450 m, (Nr. 1). H,G

Table 2: - Community of *Koeleria cristata* / *Tanacetum artemisioides* II +-3

- Community devoid of or with only sporadic *Artemisia brevifolia* I +

Table 3: - *Bistorta affinis* community-group I +

- Relevés in community of *Koeleria cristata* and *Stipa pennata* ssp. *kirghisorum* +/-

Rubia tibetica Hook.f.; 2413: Tungri, Zanskar, 3640 m, (Nr. 149); 2414: Wakha Vy. SE Mulbekh, 3750 m. H,G

Table 2: - Community of *Artemisia wellbyi* / *Lindelofia anchusoides* +

Salicaceae

Populus talassica Kom.; 2724: middle of Wakha Vy., SE Mulbekh, ca. 3650 m. P

Salix caesia Vill.; 2728: Pensi La, ca. 4420 m. NP

Salix flabellaris Anderss.; 2729: Pensi La, 4350 m; 2001: W Sanku, Suru Vy., 3880 m, (Nr. 61). Ch

Table 3: - Relevé in grassland dominated by *Kobresia royleana* and *Leontopodium leontopodium* +

Salix karelinii Turcz. (*S. hastata* auct., non L.); 2002: E of Kartse, Suru Vy., 4140 m, (Nr. 68). NP

Table 3: - *Bistorta affinis* community-group II 4

- Grassland dominated by *Carex melanantha* II r

Salix pycnostachya Anderss.; 2000: Panikhar, Suru Vy., 3300 m; 2727: middle of Wakha Vy., SE Mulbekh, 3650 m; 2726: NW Rumbak, S of Indus Vy., ca. 3700 m. NP, P

Salix wilhelmsiana M.Bieb.; 3125: E Skiu, Markha Vy., ca. 3580 m. NP

Santalaceae

Thesium hookeri Hedrych (*T. himalense* Hook.f., non Royle); 2014: S Matayan, Dras Vy., 3550 m, (Nr. 4); 2013: Mulbekh, 3250 m, (Nr. 18); 2733: N Kanda La, 4540 m, (Nr. 140). *Klim. & Srut.* (30. 8. 89): SW of Darcha, Lahul, 3650 m. G,H

Table 2: - Community dominated by *Artemisia brevifolia* + r

- Community of *Koeleria cristata* / *Tanacetum artemisioides* +

Table 3: - *Bistorta affinis* community-group I +

- *Artemisia brevifolia*-*Cicer microphyllum* community I r

- Relevés in community of *Koeleria cristata* and *Stipa pennata* ssp. *kirghisorum* +/-

Table 4: - Community-group of *Elymus canaliculatus* and *Potentilla bifurca* I-II +

Table 5: - *Caragana* community of the region of Kanda La and Matho Phu I +

Saxifragaceae

Bergenia stracheyi (Hook.f. et Th.) Engl.; not collected in Ladakh but listed in Nr. 11: S of Mulbekh, 3650 m. H,G

Table 2: - Community of *Koeleria cristata* / *Tanacetum artemisioides* +

Saxifraga cernua L.; 3126: fo. *bulbillosa* Engl. et Irm.: Nimaling, Markha Vy., 4860 m, (Nr. 201). H

Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group +

Saxifraga flagellaris Willd. ssp. *crassiflagellata* Hult.; 2205: W Matho Phu, Indus Vy., 4900 m, (Nr. 51); 2204: Alchi Brok, Indus Vy., 4500 m; 2814: Pensi La, 4360 m, (Nr. 161); 4179: SE Taglang La, 5050 m, (Nr. 261). *Klim. & Srut.* (2. 9. 89): Baralacha La, Lahul, 4640 m; (1. 9. 89): Vy. of Bhaga River, Lahul, 4160 m. Ch

Table 6: - Community dominated by *Kobresia schoenoides* V +-2

- *Poa attenuata*-*Potentilla pamirica* community-group I-III +-2

Saxifraga hirculoides Decne.; 4180: NW Taglang La, 5200 m, (Nr. 239); 5078: SE Khardung La, Indus Vy., 5100 m, (Nr. 287). H

Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group I +
- - Relevé within higher *Kobresia* grassland +

Saxifraga jacquemontiana Decne.; 2812: Pensi La, 4360 m; 4181: Rohtang Pass, Lahul, ca. 4000 m. Ch

Saxifraga jacquemontiana var. *stella-aurea* (H. & Th.) Clarke; 5077: SE below Khardung La, 5100 m, (Nr. 287). Ch

Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group I 1

Saxifraga meeboldii Engl. et Irmsch.; 2815: upper Wakha Vy., ca. 3850 m. Ch

Saxifraga sibirica L.; 2813: Zoji La, 3700 m. H

Scrophulariaceae

Euphrasia cf. *jaeschkei* Wettst.; 2470: middle of Wakha Vy., SE Mulbekh, 3600 m. T

Euphrasia kashmiriana Pugsley; 2471: cf.: Mulbekh, 3150 m; 4190: NW Sankar /Leh, ca. 3600 m; 5081: Khardung, Shyok Vy., ca. 3800 m; 6033: Darbuk /Laga, NE of Chang La, 3920 m. T

Euphrasia sp. (aff. *flabellata* Penn. or aff. *kashmiriana* Pugs.); 2261: Vy. E of Kartse, Suru Vy., 4160 m, (Nr. 67). T

Table 3: - *Bistorta affinis* community-group IV 2

Lancea tibetica Hook. f. et Th.; 2472: N Leh, 3600 m; 3187: N Leh, ca. 3650 m; 2575a: Leh, 3500 m. Bill. & Léon. 6817: near Tikse, Indus Vy., 3600 m. H

Leptorhabdos parviflora (Benth.) Benth.; Klim. & Srut. (31. 8. 89): Vy. of Bhaga River, Lahul, 3170 m and 3250 m. T

Pedicularis bicornuta Klotzsch; 2566: W Sanmodangsa, Suru Vy., 4190 m, (Nr. 87); 2567: E Kartse, Suru Vy., 4140 m, (Nr. 68); 2475: middle of Wakha Vy., SE Mulbekh, 3650 m. Klim. & Srut. (1. 9. 89): Vy. of Bhaga River, Lahul, 4160 m. H

Table 3: - *Bistorta affinis* community-group I +

- Community-group of *Festuca kashmiriana* and *Poa suruana* +

- - Relevé in grassland dominated by *Kobresia schoenoides* and *Agrostis vinealis* +

Pedicularis cheilanthifolia Schrenk var. *albida* (Penn.) Tsoong; 3191: Tchatchutse, Markha Vy., ca. 4400 m; 4185: NW Sankar /Leh, ca. 3630 m; 6034: Muglib, ca. 15 km W of Pangong Tso, 4120 m. H

Pedicularis gracilis Wall.; 4183: S Rohtang Pass, Him.-Prad., ca. 3250 m. T, H

Pedicularis heydei Prain; 4184: NW Taglang La, 4900 m. H

Table 6: - Relevé within higher *Kobresia* grassland 1

Pedicularis kashmiriana Pennell; 2572: SE Matayan, Dras Vy., 3450 m, (Nr. 5). H

Table 3: - Relevés in community of *Koeleria cristata* and *Stipa pennata* ssp. *kirghisorum* 1/1

Pedicularis longiflora Rud. var. *tubiformis* (Klotzsch) Tsoong; 2565: S Matho, Indus Vy., 3600 m; 2477: Mulbekh, ca. 3300 m; 2476: NW Rumbak, S Indus Vy., 3800 m; 3190: Tchatchutse, Markha Vy., 4400 m. H

Table 6: - Incomplete species list (11) from the catchment area of Tso Moriri

Pedicularis pectinata Wall.; 2571a: E Kartse, Suru Vy., 4160 m, (Nr. 67). Klim. & Srut. (30. 8. 89): SW Darcha, Lahul, 3650 m; (13. 9. 89): Zoji La, 3330 m. H

Table 3: - *Bistorta affinis* community-group IV +-1

Pedicularis punctata Decne. (*P. siphonantha* auct.); 2573a: Panikhar, Suru Vy., 3300 m; 2574a: Dras, ca. 3200 m. Moh. Deen (11. 8. 92): Shergol, W-Ladakh. H

Pedicularis pycnantha Boiss. cf. ssp. *semenovii* (Regel) Prain; 2569: Sanmodangsa, Suru Vy., 3950 m, (Nr. 81). H

Table 2: - Community dominated by *Artemisia brevifolia* II +

Table 3: - *Artemisia brevifolia*-*Cicer microphyllum* community IV +

- *Bistorta affinis* community-group I +

- - Relevés in community-group of *Festuca kashmiriana* and *Poa suruana* +/-

Pedicularis pycnantha ssp. *typica* Pennell; 2568: SW Dras, 3450 m, (Nr. 1). H

Table 2: - Community of *Koeleria cristata* / *Tanacetum artemisioides* V +-1

- Community dominated by *Artemisia brevifolia* I +-1

Table 3: - Relevé in community of *Koeleria cristata* and *Stipa pennata* ssp. *kirghisorum* +

- Relevé in a transitional zone between subalpine steppe and *Bistorta affinis* community +

Pedicularis pyramidata Royle; 2570: W Sanmodangsa, 4340 m, (Nr. 89). H

Table 3: - Community-group of *Festuca kashmiriana* and *Poa suruana* II +-1

Pedicularis rhinanthoides Schrenk ssp. *speciosa* Pennell; 3189: Tchatchutse, Markha Vy., 4380 m; 4186: S Runtse, N Taglang La, 4500 m; 6035: ca. 11 km E Tsoltak, N of Chang La, 4600 m. H

Picrorhiza kurrooa Royle; 2469: Zoji La, 3800 m. H

Scrophularia dentata Royle; 3192: Kongmaru La to Shang, Indus Vy., ca. 4200 m; 4187: S Runtse, N of Taglang La, 4550 m, (Nr. 229). H,(Ch)

Table 4: - Community-group of *Krascheninnikovia pungens* / *Ptilotrichum canescens* II +-2

- *Stipa glareosa*-*Krascheninnikovia pungens* community II +-2

- Relevé in a succession stage of *Artemisia wellbyi* 1

Scrophularia koelzii Penn.; 2479: Tungri, Zanskar, 3640 m, (Nr. 149). Klim. & Srut. (12. 9. 89): E Dras, 2960 m. Bill. & Léon. 6832: between Götsang Gompa and Hemis, 3900 – 4000 m. H

Table 2: - Community of *Artemisia wellbyi* / *Lindelofia anchusoides* II +-1

Scrophularia nudata Penn.; 2563a: S Namika La, 3880 m, (Nr. 16); 2564a: E Mulbekh, 3300 m. Bill. & Léon. 6783: near Kargil, 2950 m. H

Table 2: - Community dominated by *Artemisia brevifolia* I +-1

- *Stachys tibetica* community II +

- Community of *Koeleria cristata* / *Tanacetum artemisioides* I +

- Community of *Artemisia wellbyi* / *Lindelofia anchusoides* +

- Relevés in the low subalpine steppe-desert +/-

Verbascum thapsus L.; not collected but remarked in different vegetation relevés (Nrs. 60, 62, 64, 85, 111 and others). Klim. & Srut. (13. 9. 89): Zoji La, 3330 m. T,H

Table 2: - Community of *Artemisia wellbyi* / *Lindelofia anchusoides* II r+

- Relevé of a rock debris community devoid of or with only sporadic *Stachys tibetica* +

Veronica beccabunga L.; 4188: Shey, Indus Vy., 3300 m. H,A

Veronica biloba L.; 2258: SW Dras, 3450 m, (Nr. 1); 2257: SE Matayan, Dras Vy., 3450 m, (Nr. 5); 4189: Debring, Rupshu, 4850 m. Klim. & Srut. (13. 9. 89): Zoji La, 3330 m; (31. 8. 89): Vy. of Bhaga River, Lahul, 3170 m; (1. 9. 89): Vy. of Bhaga River, 4160 m. T

Table 2: - Community dominated by *Artemisia brevifolia* III +-2

- Community devoid of or with only sporadic *Artemisia brevifolia* III +-2

- Community of *Koeleria cristata* / *Tanacetum artemisioides* II +-2

- Relevés of the *Koeleria cristata* community 1/2

- Community of *Artemisia wellbyi* / *Lindelofia anchusoides* I +-2

Table 3: - Community-group of *Festuca kashmiriana* and *Poa suruana* IV 1-2

- *Bistorta affinis* community-group III 1-2

- Community of *Koeleria cristata* and *Stipa pennata* ssp. *kirghisorum* IV 1-2

- Relevé in grassland dominated by *Carex pseudofetida* 2

- Relevé in grassland dominated by *Kobresia schoenoides* and *Agrostis vinealis* +

Veronica lanosa Royle ex Benth.; 2259: S Yasghun, Dras Vy., 3540 m, (Nr. 9); 2562: W Panikhar, Suru Vy., 3660 m, (Nr. 103). Klim. & Srut. (30. 8. 89): SW Darcha, Lahul, 3650 m. Ch

Table 2: - Community dominated by *Artemisia brevifolia* +

Table 3: - *Bistorta affinis* community-group II +-1

- Relevé in a transitional zone between subalpine steppe and *Bistorta affinis* community 2

Veronica salina Schur; 2473: Mulbekh, ca. 3200 m; 5080: S Matho, Indus Vy., 3650 m. T,H

Veronica uncinata Pennell; 2260: SW Matho Phu, Indus Vy., 4540 m, (Nr. 47). T

Table 4: - Community-group of *Elymus canaliculatus* and *Potentilla bifurca* +

Solanaceae

Hyoscyamus pusillus L.; 2417: Mulbekh, ca. 3150 m. Bill. & Léon. 6807: Khalsi, Indus Vy., 2950 m. T

Lycium ruthenicum Murray; 2255: W Nimu, Indus Vy., 3500 m; (1992): Palace hill of Leh, ca. 3550 m; (4. 8. 95): Nubra Vy. up to Panamik, very common, 3000 – 3200 m. NP

Physochlaina praealta (D. Don) Miers; 2256: S Matho, Indus Vy., 4030 m, (Nr. 54); 2418: N Leh, 3650 m; 3193: N Leh, ca. 3650 m. Bill. & Léon. 6831: betw. Hemis and Götsang Gompa, Indus Vy., 3900-4000 m. G,(H)

Table 1: - Communities of the higher subalpine desert +

Table 2: - *Stachys tibetica* community IV +

- Community of *Artemisia wellbyi* / *Lindelofia anchlussoides* I +

Table 4: - *Stipa glareosa*-*Krascheninnikovia pungens* community II +

- Community-group of *Potentilla bifurca* / *Artemisia gmelinii* +

Tamaricaceae

Myricaria germanica (L.) Desv. ssp. *alopecuroides* (Schrenk) Kit.; 2797: Mulbekh, ca. 3250 m; 4191: E Choglamsar, S Leh, 3300 m. NP

Tamaricaria elegans (Royle) Qaiser et Ali; 2796: NW Rumbak, S Indus Vy., 3700 m; 3127: Yangtang, Indus Vy., ca. 3550 m. Bill. & Léon. 6882: Ritzong River, E Khalsi, 3150 m. NP

Urticaceae

Urtica hyperborea Jacquem.; 2732: Stok Phu, Indus Vy., ca. 4500 m. H,(Ch)

Table 4: - Community-group of *Elymus canaliculatus* and *Thermopsis inflata* / *Biebersteinia odora* III +

Table 5: - *Caragana* community of the region of Matho Phu and Kanda La II +

- Relevé in the *Caragana* community at the high valley of Nimaling +

Table 6: - *Poa attenuata*-*Potentilla pamirica* community-group I-II r +

Valerianaceae

Valeriana clarkei Briq. (*V. elegans* C.B. Clarke); 2003: W Panikhar, Suru Vy., 3390 m, (Nr. 109). H

Table 2: - *Stachys tibetica* community I r

Valeriana himalayana Grub. (*V. dioica* sensu C.B. Clarke); 2485: Stok Phu, Indus Vy., 4550 m (Nr. 120). H

Table 4: - Community-group of *Elymus canaliculatus* and *Thermopsis inflata* / *Biebersteinia odora* I +

Violaceae

Viola kunawarensis Royle; 2004: S Mulbekh, 3740 m, (Nr. 10). Bill. & Léon. 6879: Tirdik, N Sabu, 4200 m. H,(G)

Table 2: - Community of *Koeleria cristata* / *Tanacetum artemisioides* II +

- Relevé in the low subalpine steppe-desert +

Viola rupestris F.W. Schmidt (*V. arenaria* DC.); 2005: Yasghun, Dras Vy., 3540 m, (Nr. 9). H

Table 3: - Relevés in the transitional zone between subalpine steppe and *Bistorta affinis* community +/1

Zygophyllaceae

Peganum harmala L.; 3131: Martselang / Hemis, ca. 3450 m. Ch

Table 1: - Communities of the higher subalpine desert r

Tribulus terrestris L.; 2806: S Leh, 3430 m. T

o.K.

9. Examples to present a so-called "vegetation-formula"

In order to characterize in the briefest form the 400 species, which are listed in one or a few of the 6 Tables, in relation to the vegetation which they present, a so called vegetation-formula, which always relates to one of the 6 main Tables (= Tables), is used. With three examples, it is briefly explained: the first value (to the left of the solidus) indicates the number of columns in which the species is presented. The second value (to the right of the solidus) gives the number of columns in the corresponding main Table. To the right follows the range of classes of presence degree followed by the range of the cover-abundance in the relevés of this Table. Separated by a comma follows to the right the range of the cover-abundance in the single relevés.

Bistorta affinis

Table 2 (13 columns): subalpine steppe communities

↓
 $\underline{3/13} \text{ } +\text{--II} \text{ } +\text{--}3$
 ↙ ↑ ↑ ↑
 3 columns (here with tables) and the classes of presence degree (+--II)
 cover-abundance within relevés of tables (+--3)

Arabis tibetica

Table 3 (bold-faced!) 13 columns: subalpine turf and steppe-meadow communities (W Ladakh)

↓
 $\underline{3/13} \text{ } \text{I--IV} \text{ } +\text{--}1, \text{ } +$
 ↙ ↑ ↑ ↑
 3 columns (2 with tables, 1 single relevé) and classes of presence degree (I – IV) of the tables
 cover-abundance within relevés of tables (+--1)
 cover-abundance of a single relevé (behind comma!) +

Bistorta vivipara

Table 6 (9 columns): grassland communities of the alpine and highalpine belt

↓
 $\underline{6/9} \text{ } +\text{--II} \text{ } +\text{--}2, \text{ } +\text{--}2, \text{ } \underline{10}, \text{ } \underline{11}$
 ↙ ↑ ↑ ↑ ↑ ↑
 6 columns (3 with tables) and corresponding classes of presence degree (+--II)
 cover-abundance within relevés of the tables
 cover-abundance of single relevés (here 3 !)
 incomplete species lists (10 – 12) in turfs of the alpine belt

10. Alphabetical order of the species listed in the 6 main Tables (with the “vegetation-formulas”)

The following list includes in alphabetical order all taxa (species, subspecies and varieties) which were registered at least in one relevé. The added formula-like short-description (“vegetation-formula”) shows in which Tables and herewith in what kind of plant communities the taxon has been stated. With the details to the class of presence degree and with the cover-abundance index the synecological informations are supplemented.

<i>Acantholimon lycopodioides</i> (Gir.)Boiss.	2/7 r-Vr-1	2/13 II+-1,r	5/13 III-Vr-2,+3	5/12 I-Vr-3
<i>Aconitum violaceum</i> Jacq.ex Stapf	2/13 IV1,2			
<i>Aconogonon rumicifolium</i> (Royle)Hara	1/13 +	1/9 I+		
<i>Aconogonon sibiricum</i> Laxm.ssp.thomsonii	2/9 +-1,12			
<i>Aconogonon tortuosum</i> (D.Don)Hara	4/13 II-IIIr-3,+	4/13 IV+-4,+1	6/12 I-Vr-4,1-2	1/5 I+
<i>Agrostis vinealis</i> Schreb.	3/13 I-IIIr-3, 2	4/13 II+-2,1-3		
<i>Allium oreoprasum</i> Schrenk.	1/12 I1			
<i>Allium przewalskianum</i> Regel	1/13 +	2/12 I-IIIr-2		
<i>Alopecurus arundinaceus</i> Poir.	4/13 III-V+-1,+1			
<i>Anaphalis triplinervis</i> (Sims.)Clarke	1/13 +			
<i>Anaphalis virgata</i> Thoms.ex Clarke	2/13 I+ ,+			
<i>Androsace aizoon</i> Duby var.himalaica Kbh.	1/13 +			
<i>Androsace robusta</i> Hd.-Mzt.ssp.robusta Y.Nasir	1/7 2	5/13 I-IIIr-2,+	2/13 III-V+-2	6/12 +-II+-1,+
<i>Androsace cf.robusta</i> Hand.-Mazz.	1/5 II1			
<i>Androsace septentrionalis</i> L.	1/12 +	3/9 +-II+		
<i>Aphragmus oxycarpus</i> (Hook.f.et Th.)Jafri	6/9 +-II+-1,+			
<i>Arabis tenuirostris</i> Schulz	1/13 +			
<i>Arabis tibetica</i> Hook.f.et Th.	6/13 I-II+-1,+	3/13 I-IV+-1,+	5/12 +-IV+-2	4/9 +-II+-2 2/5 II+
<i>Arenaria bryophylla</i> Fern.	3/9 II-IV+-2	3/5 I-Vr-2, +	1/12 Ir	
<i>Arenaria griffithii</i> Boiss.	4/13 II-III+-2,1-2	3/13 II-III+,2		
<i>Arnebia euchroma</i> (Royle)J.M.Johnst.	2/13 II+,+	6/13 I-IIIr-1,+	2/12 +-Ir	
<i>Arnebia guttata</i> Bunge	3/7 +-IIIr-1, r	1/13 +	1/12 IIr+	
<i>Artemisia brevifolia</i> Wall.	4/7 II-IVr-3,+3	7/13 III-V+-4,r-2	12/13 II-Vr-4,+1	1/9 IV+-2 1/12 II1-3
<i>Artemisia gmelinii</i> Web.ex Steckm.	1/7 Vr-2	4/13 I-IIIr+-1,4	9/12 +-Vr-3	3/5 II-III+-3, 1 2/9 +-II+
<i>Artemisia macrocephala</i> Jacq.ex Bess.	1/12 +	12		
<i>Artemisia minor</i> Jacq.ex Bess.	3/12 +-IVr-3	2/5 II-V1-3	2/9 +-II+	
<i>Artemisia parviflora</i> Roxb.	1/13 +			
<i>Artemisia persica</i> Boiss.	2/13 +,r			
<i>Artemisia scoparia</i> Waldst.& Kit.	1/13 1			
<i>Artemisia stricta</i> Edgew.	1/13 +	1/12 V+-3	1/5 I+	12
<i>Artemisia tournefortiana</i> Reichb.	12			
<i>Artemisia wellbyi</i> Hemsl.et Pears.	5/13 +-IVr-3,3	4/12 +-IIIr-3,2	1/13 I+	
<i>Aster flaccidus</i> Bge.ssp.flaccidus Griers.	3/13 IV+-1, +	7/9 II-IV+-2,1-2		
<i>Astragalus confertus</i> Benth.	1/5 II1	6/9 II-III+-3,+1,11		
<i>Astragalus falconeri</i> Bunge	3/13 +-II+-1			
<i>Astragalus heydei</i> Baker	1/12 Ir			
<i>Astragalus hoffmeisteri</i> (Klotzsch.)Ali	1/13 I+			
<i>Astragalus macropterus</i> DC.	1/13 I+			
<i>Astragalus munroi</i> Benth.ex Bge.	1/7 r	1/13 +	1/12 Ir	
<i>Astragalus nivalis</i> Kar.et Kir.	2/13 I+,1			
<i>Astragalus oplites</i> Benth.	3/7 +-II+, r	10/13 +-Vr-3,+2	2/13 +-1	4/12 I-IV+-2
<i>Astragalus peduncularis</i> Royle	2/13 +-I+			
<i>Astragalus rhizanthus</i> Royle	2/13 I-II+	1/9 II1-2	6/13 I-V+-2,+2	
<i>Astragalus cf. rhizanthus</i> Royle	1/12 +			
<i>Astragalus strictus</i> Grah.	1/9 II1	1/12 II+-1		
<i>Astragalus subuliformis</i> DC.	3/13 I-II+,+			
<i>Astragalus tecti-mundi</i> Freyn.	3/13 I-V+-1,+			
<i>Axyris hybrida</i> L.	1/13 I+	2/13 I-II+-1	1/12 I+	1/5 II1
<i>Bassia fiedleri</i> Aellen	2/7 +			
<i>Bassia stellaris</i> (Moq.)Bornm.	2/7 +-1			
<i>Berberis</i> sp.	1/13 r			
<i>Berberis ulicina</i> Hook.f.et Th.	1/13 Ir			
<i>Bergenia stracheyi</i> (Hook.f.et Th.)Engl.	1/13 +			
<i>Biebersteinia odora</i> Steph.	2/12 III2-3,1	1/9 II1		
<i>Bistorta affinis</i> (D.Don)Greene	3/13 +-II+-3	5/13 I-V+-5,+4	2/9 +-IV+-1	
<i>Bistorta vivipara</i> (L.)S.F.Gray	1/13 +-2	6/9 +-II+-2,+2, 10,11		
<i>Blysmus compressus</i> (L.)Panz.ex Link	11			
<i>Botrychium lunaria</i> (L.)Sw.	1/13 r			

<i>Brachyactis pubescens</i> (DC.)Aitch.	2/13 II+,+				
<i>Brachyactis roylei</i> (DC.)Wend.	5/13 I-III+-1, +				
<i>Bromus confinis</i> Nees ex Steud.	3/13 +-1	1/12 I+			
<i>Bromus oxyodon</i> Schrenk	4/13 I-V+-2	2/13 I+			
<i>Bromus tectorum</i> L.	4/13 +-II+, +-1				
<i>Bupleurum gracillimum</i> Klotzsch	3/13 IIr-1, 1-2				
<i>Bupleurum longicaule</i> Wall.var.himalayense Cl.	4/13 IV-V+-1,+-1				
<i>Bupleurum thomsonii</i> C.B.Clarke	1/13 +	1/13 2			
<i>Calamagrostis epigejos</i> (L.)Roth	2/13 IV-V+-3				
<i>Calamagrostis holciformis</i> JB.et SP.	2/9 1-3, 10, 12				
<i>Calamagrostis pulchella</i> Griseb.	1/9 I1				
<i>Campanula pallida</i> Wall.var.tibetica (Hk.f.)Hara	1/7 r	3/13 II+-1, r-+			
<i>Capparis spinosa</i> L.	1/7 I+				
<i>Caragana versicolor</i> Benth.	5/12 I-IIIr-2	4/5 V3-5, 3-4			
<i>Carex borii</i> Nelmex fo.lutea R.R.S.	2/9 II-4, 2				
<i>Carex melanantha</i> C.A.Mey.	2/13 V5,1				
<i>Carex montis-everestii</i> Kükenthall	1/9 2				
<i>Carex moorcroftii</i> Falc.ex Boott	2/13 I-V+-5	5/9 I-III+-2, +	2/12 I-IV1-3	1/5 I1	
<i>Carex plectobasis</i> V.Krecz.	1/13 1				
<i>Carex pseudofortida</i> Kük.	6/13 I-II+-2, 1	4/13 I-II+-1, 1-4	5/9 I-V+-4	1/5 I+	1/12 +
<i>Carex sagaensis</i> Y.C.Yang	4/9 II1-2, 2-3, 11				
<i>Carex stenocarpa</i> Turcz.ex Krecz.	1/13 II2				
<i>Carex stenophylla</i> Wahlenb.	4/7 r-II1-2, +-1	5/13 +-IV+-2	1/13 I+	4/12 +-I1	1/9 I+, 10
<i>Cerastium cerastioides</i> (L.)Britt.	1/13 V+-1	3/9 II-V+-2			
<i>Cerastium pusillum</i> Ser.	2/9 II+-1				
<i>Chamaerhodos sabulosa</i> Bunge	1/13 I+	2/12 +-IIr-1			
<i>Chenopodium botrys</i> L.	3/7 I+-1, r-+	3/13 I-IIr-1, 1			
<i>Chenopodium foliosum</i> (Moench)Asch.	1/13 I+				
<i>Chenopodium karoi</i> (Murr)Aellen	3/7 +, +	1/12 II+			
<i>Chenopodium cf.karoi</i> (Murr)Aellen	1/13 I+	1/5 I+			
<i>Chenopodium pamiricum</i> Iljin	1/5 II+-2	2/12 I+-1	12		
<i>Chesneya cuneata</i> (Benth.)Ali	3/7 IIr-1, +	4/13 I+-1, 1			
<i>Chorispora sabulosa</i> Camb.	2/13 +, +				
<i>Christolea crassifolia</i> Camb.	1/7 I+-2	3/13 +-I+-1	4/12 +-IVr-2	1/9 IIr	
<i>Christolea himalayensis</i> (Camb.)Jafri	1/9 +				
<i>Christolea stewartii</i> Jafri	1/5 I+				
<i>Chrysanthemum griffithii</i> Clarke	1/13 +				
<i>Chrysanthemum pyrethroides</i> Fedtsch.	3/12 Ir+-, 1	1/5 II+-1	1/9 II1		
<i>Chrysanthemum pyrethroides</i> Ftsch.var.tomentosa	3/13 +-III+-2, +				
<i>Cicer microphyllum</i> Benth.	2/7 +	4/13 I-IIIr-3, +	5/13 II-V+-2, 1-2	1/12 +	1/9 II+
<i>Convolvulus arvensis</i> L.	1/13 +				
<i>Corispermum tibeticum</i> Iljin	1/12 I2				
<i>Corydalis flabellata</i> Edgew.	2/7 +-I+-1				
<i>Cotoneaster uniflora</i> Bunge	1/13 I1				
<i>Cousinia thomsonii</i> Clarke	5/13 I-IIr-+	1/13 I+			
<i>Cremanthodium ellisii</i> (Hook.f.)Kitam.	2/9 II+, 1				
<i>Crepis flexuosa</i> (DC.)Benth.et Hook.f.	5/7 +-III+-2, r-2	4/13 +-II+-1	5/12 +-IIIr-1, 1		
<i>Crepis multicaulis</i> Led.ssp.congesta Bab.	1/12 +				
<i>Cuscuta cf. capitata</i> Roxb.	2/13 I+, 1	1/7 +			
<i>Cuscuta planiflora</i> Tenore	2/13 +-I+				
<i>Cynoglossum glochidiatum</i> Wall.ex Benth.	4/13 +-II+-1, +				
<i>Cystopteris dickieana</i> R.Sim.	1/13 +	2/9 I-IIr-+			
<i>Dasiphora dryadanthoides</i> Juz.	4/9 +-IIr-2	1/12 +			
<i>Delphinium brunonianum</i> Royle	2/12 IIr-+, +	3/9 +-II+			
<i>Delphinium cashmerianum</i> Royle	1/13 V+-1	1/9 I+			
<i>Descurainia sophia</i> Webb.et Berth.	1/7 +				
<i>Dianthus anatolicus</i> Boiss.	6/13 II-V+-2, +-1	8/13 I-V+-1, r-2	1/9 I1		
<i>Draba altaica</i> Bunge	6/9 +-V+-2, +				
<i>Draba cachemirica</i> Gandager	6/13 I-V+-3, +-2	2/13 IIIr-2, r			
<i>Draba glomerata</i> Royle	1/5 Ir	2/9 II-IV+-2			
<i>Draba lanceolata</i> Royle	2/5 II+, +	2/9 +-II+-1			
<i>Draba oreades</i> Schrenk	2/9 I-II+-2				
<i>Draba setosa</i> Royle	2/9 II+-1				
<i>Draba stenocarpa</i> Hook.f.et Th.	2/13 IVr-+, +-1				
<i>Draba tibetica</i> Hk.f.et Th.var.tibetica Jafri	2/13 I-IV+-2	1/13 I+			
<i>Dracocephalum heterophyllum</i> Benth.	9/12 +-IIIr-2	2/5 III-V+-1	1/9 I+, 12		
<i>Echinops cornigerus</i> DC.	2/7 II-IVr-1	2/13 r-+			
<i>Elsholtzia eriostachya</i> Benth.var.pusilla Hk.f.	2/5 I-III+-2	1/9 I+-2			
<i>Elymus canaliculatus</i> (Nevski)Tzvel.	3/7 +-IV1-2, 1	10/13 II-III+-2, +-1	4/13 II-IV+-2	7/12 I-V+-2, 1	3/9 +-IV+-2 1/5 III+-2
<i>Elymus cognatus</i> (Hack.)Cope	6/13 II-V+-2	1/13 1	1/12 III+		
<i>Elymus dentatus</i> (Hook.f.)T.A.Cope	1/9 I+				
<i>Elymus fedtschenkoi</i> Tzvel.	1/13 +				
<i>Elymus jacquemontii</i> (Hook.f.)Tvel.	5/12 I-III+-2	3/5 IV+-2, 1	3/9 II+-2, 1		
<i>Elymus nutans</i> Griseb.	3/12 I-II+	1/5 III1-2	12		

<i>Elymus schrenkianus</i> (Fisch.et M.)Tzvel.	2/9 II+	1/12 +	2/5 I2, 1		
<i>Elymus schugnanicus</i> (Nevski)Tzvel.	1/13 II+-2	2/12 III+-2,+	1/9 III+-2		
<i>Elymus x incertus</i> Hartm.	1/13 +				
<i>Ephedra gerardiana</i> Wall.	6/13 I-IVr-2,+	5/13 I-II r-1,r-2	5/12 +-IV r-2,+	2/9 I-II r-3	
<i>Ephedra intermedia</i> Schrenk & Mey.	1/7 +				
<i>Ephedra regeliana</i> Florin	5/7 IIr-2, +-2	2/13 I-III+-1			
<i>Epilobium angustifolium</i> L.	5/13 IV-V+-1,+	1/9 I+			
<i>Epilobium laxum</i> Royle	2/13 +-1				
<i>Equisetum ramosissimum</i> Desf.	1/13 I+				
<i>Eritrichium canum</i> Kitam.	7/13 I-IVr-2,+1	4/12 II-IVr-2	1/5 II+-1		
<i>Erodium tibetanum</i> Edgew.	3/7 II+-1, +	1/12 I+			
<i>Erysimum mellicentae</i> Dunn	1/13 +				
<i>Euphorbia thomsoniana</i> Boiss.	1/13 I+-1	1/13 +			
<i>Euphorbia tibetica</i> Boiss,	6/7 II-IIIr-1, +-1	5/13 I-IV+-1,1	9/12 I-Vr-2		
<i>Euphrasia</i> sp.	1/13 V2				
<i>Festuca alaica</i> Drob.	3/13 V+-2,1-2	3/13 I-III+-2	3/12 +-II+-2,1	2/9 II-III+-1	1/5 I+
<i>Festuca kashmiriana</i> Stapf	1/13 I+-2	4/13 V+-4,2-4		2/9 +-IV1-3	
<i>Festuca olgae</i> (Regel)Krivot.	1/13 V+-3	3/12 +-II+,1	2/5 II+-1	3/9 I-IIIr-3	
<i>Festuca rubra</i> L.ssp. <i>arctica</i> (Hack.)Govar	2/13 IV+-1-2	1/13 +			
<i>Festuca tibetica</i> (Stapf)Alex.	2/9 I-IV+-2				
<i>Filago arvensis</i> L.	4/13 I-IIIr-+,+-1				
<i>Gagea elegans</i> Wall.ex Don	1/9 +				
<i>Galium boreale</i> L.	2/13 +-1				
<i>Galium verum</i> L.	2/13 I-II+-3	2/13 I+,+-1			
<i>Gentiana algida</i> Pall.var. <i>nubigena</i> (Edg.)Kusn.	2/9 +,+				
<i>Gentiana azurea</i> Bunge	2/9 r-2				
<i>Gentiana borealis</i> Bunge	1/13 +				
<i>Gentiana carinata</i> Griseb.	1/13 +	1/9 +			
<i>Gentiana falcata</i> Turcz.	1/9 +,11,12				
<i>Gentiana leucomelaena</i> Maxim.	1/13 +	2/9 II+-1,+11,12			
<i>Gentiana moorcroftiana</i> Wall.	2/13 V+-1,+				
<i>Gentiana pedunculata</i> Royle ex D.Don	1/13 I+				
<i>Gentiana prostrata</i> Haenke	11.12				
<i>Gentiana pseudoaquatica</i> Kusnez.	3/9 III+,1-2				
<i>Gentiana thomsonii</i> Clarke	2/9 +,1				
<i>Gentiana tianshanica</i> Rupr.	3/13 II-V+-2,+	2/9 +-I+			
<i>Geranium himalayense</i> Klotzsch	5/13 III-Vr-2,+1	1/9 IV+-3			
<i>Geranium pratense</i> L.ssp. <i>stewartianum</i> Y.Nas.	1/13 +-1				
<i>Geranium</i> cf. <i>regelii</i> Nevski	2/13 III+,+	1/13 I+	1/12 +	1/9 II1	1/5 I1
<i>Glaux maritima</i> L.	1/9 2,12				
<i>Gypsophila sedifolia</i> Kurz	2/7 +	3/13 I-IIIr-+			
<i>Halogeton arachnoideus</i> Moq.	1/12 II+				
<i>Halogeton glomeratus</i> C.A.Mey.	3/7 IIr-2, +				
<i>Haloxylon thomsonii</i> Bunge	2/7 II-IVr-2				
<i>Helictotrichon hookeri</i> (Scribn.)Henr.	4/13 I-II+-1,+1	1/13 I+			
<i>Heracleum pinnatum</i> C.B.Clarke	2/7 r-IIr	4/13 +-Vr-3	1/13 IVr-+	2/12 I+,+	
<i>Heteropappus semiprostratus</i> Griens.	2/12 +				
<i>Hieracium prenanthoides</i> Vill.	1/13 +-1				
<i>Hieracium umbellatum</i> L.	1/13 r	1/13 Ir			
<i>Hylotelephium ewersii</i> (Led.)H.Ohba	1/13 I+				
<i>Hypecoum leptocarpum</i> Hook.f.et Th.	1/12 I+	12			
<i>Inula obtusifolia</i> Kerner	1/7 r				
<i>Inula rhizocephala</i> Schr.var. <i>rhizocephaloides</i> Kt.	1/13 +				
<i>Iris hookeriana</i> Foster	1/13 r-+				
<i>Juncus thomsonii</i> Buchen.	11				
<i>Jurinea ceratocarpa</i> (Decne.)Benth.	1/9 I+				
<i>Jurinea ceratocarpa</i> Benth.var. <i>depressa</i> Cke.	1/13 I+	1/13 +-1			
<i>Kobresia capillifolia</i> (Decne.)Clarke	1/13 IV1-2	2/5 I-II1-2	2/9 +-II1-2		
<i>Kobresia karakorumensis</i> Dickoré	2/9 +-II1-2				
<i>Kobresia kashgarica</i> Dickoré	11				
<i>Kobresia pygmaea</i> C.B.Clarke	11				
<i>Kobresia royleana</i> (Nees)Boeck.	2/13 II+,4	1/12 +	1/5 III+-1	5/9 +-III+-3,2-3,11,12	
<i>Kobresia schoenoides</i> (C.A.Mey.)Steud.	3/13 II-IV+-2,3	8/9 II-V+-5,1-3,10			
<i>Kochia prostrata</i> (L.)Schr.	1/7 r	1/13 IV+-1	3/13 I-IIr-1		
<i>Koeleria cristata</i> (L.)Pers.	7/13 I-IVr-4,2-3	10/13 III-V+-3,+3	3/12 I-II+-4	1/9 +	1/5 I1
<i>Koelpinia linearis</i> Pallas	1/13 I1				
<i>Krascheninnikovia pungens</i> (Pazij)Podlech	3/7 IIr-2, +-2	5/13 I+-1, r	8/12 III-Vr-3	5/5 I-V+-2, +-3	
<i>Lactuca orientalis</i> Boiss.	1/7 I+-1	1/13 +-1			
<i>Lactuca tatarica</i> C.A.M.var. <i>tibetica</i> Hook.f.	2/13 +,+				
<i>Lappula heterantha</i> (Led.)Gürke	1/13 Ir+	1/12 +			
<i>Leontopodium leontopodium</i> (DC.)Had.-Mzt.	10/13 I-V+-3,+2	5/13 +-III+-3,+	4/12 I-IIr-2,+	3/9 I-V+-2,10	
<i>Leontopodium nanum</i> (Hk.f.et Th.)Hnd.-Mzt.	5/9 IV-V+-3,1,11	2/5 I-II+-3	1/12 +		
<i>Lepidium apetalum</i> Wild.	1/13 II+	1/12 II+			

<i>Lepidium latifolium</i> L.	1/7 r			
<i>Leymus secalinus</i> (Georgi)Tzvel.	3/13 +-II+	4/12 I-V+-3	12	
<i>Lindelofia anchusoides</i> (Lindl.)Lehm.	2/13 II-IV+-4	5/13 I-Vr-2,+		
<i>Lindelofia stylosa</i> (Kar.et Kir.)Brand	4/12 +-IV+-1,+	2/9 +-II+	1/5 IIr	
<i>Lloydia serotina</i> (L.)Rchb.	2/9 II+-1			
<i>Lomatogonium carinthiacum</i> (Wulf.)A.Br.	1/13 1	2/9 II+-2,1,11,12		
<i>Lomatogonium coeruleum</i> (Royle)H.Sm.	1/13 IV+-1			
<i>Lomatogonium thomsonii</i> (Clarke)Fern.	1/9 +			
<i>Lonicera asperifolia</i> (Dcne.)Hook.f.et Th.	3/13 +-Irr+	2/13 I-Irr+		
<i>Lonicera heterophylla</i> Decne.	1/12 +			
<i>Lonicera spinosa</i> (Decne.)Walp.	1/13 Ir	1/5 I1	1/12 +	1/9 II2
<i>Marmoritis rotundifolia</i> Benth.	1/12 I+			
<i>Marrubium marrubiastrum</i> (Steph.)Hedge	1/5 I+	1/12 +		
<i>Matthiola flavida</i> Boiss.	5/7 II-IIIr-2, 1	3/13 I-IIIr-1		
<i>Mattiasstrum himalayense</i> Brand	1/7 +	3/13 II+,+		
<i>Medicago falcata</i> L.	1/13 r			
<i>Medicago sativa</i> L.	1/7 r			
<i>Melica persica</i> Kunth	4/13 +-III+-1,+			
<i>Minuartia kashmirica</i> (Edg.)Mattf.	2/7 r, +	2/13 +,+-3	1/12 IV+-1	
<i>Morina coulteriana</i> Royle	1/13 Irr+			
<i>Myosotis asiatica</i> Schischk.et Serg.	4/13 II-IV+-1,1-2	1/13 +	2/9 +-I+	
<i>Nepeta annua</i> Pallas	1/7 +			
<i>Nepeta discolor</i> Royle ex Benth.	10/13 II-V+-3,+-2	8/13 +-Vr-3,r-1	6/12 I-IIIr-2,1	3/9 II-V+-3
<i>Nepeta floccosa</i> Benth.	2/7 IV+-2	3/13 +-II+-1	1/12 I2	
<i>Nepeta glutinosa</i> Benth.	1/7 IIIr-2	3/13 +,+	2/12 V+-3,3	
<i>Nepeta leucolaena</i> Benth.ex Hook.f.	3/7I-IIIr-2, +	4/13 III-IVr-2,+-2		
<i>Nepeta longibracteata</i> Benth.	2/9 +-III+			
<i>Orobanche cernua</i> Loeffl.	2/13 +			
<i>Oxytropis cachemiriana</i> Camb.	4/13 II+-1, +	2/9 III-IVr-2		
<i>Oxytropis chiliophylla</i> Royle ex Benth.	1/9 I+			
<i>Oxytropis densa</i> Benth.ex Bunge	1/9 IV+-1			
<i>Oxytropis humifusa</i> Kar.et Kir.	5/9 +-V+-3	4/12 +-IVr-3	1/13 IV+	
<i>Oxytropis hypoglottoides</i> (Baker)Ali	1/9 4			
<i>Oxytropis lapponica</i> (Wahl.)Gay	3/13 I-IV+-1,1			
<i>Oxytropis microphylla</i> (Pallas)DC.	4/7 r, +-2	8/12 II-Vr-2	1/13 IIr-2	1/5 I+
<i>Oxytropis mollis</i> Royle	3/13 IV+-1,+-1	5/13 I-II1,+-1	2/12 III+-1,+	
<i>Oxytropis tatarica</i> Camb.ex Bge.	5/12 +-Vr-2	2/5 IV+-1	4/9 +-V+-2,1,10	
<i>Parnassia laxmannii</i> Pallas ex Schult.	1/13 +			
<i>Parnassia pusilla</i> Wall.ex Arn.	11			
<i>Pedicularis bicornuta</i> Klotzsch	3/13 II+,+			
<i>Pedicularis heydei</i> Prain	1/9 1			
<i>Pedicularis kashmiriana</i> Pennell	1/13 1			
<i>Pedicularis longiflora</i> Rud.var. <i>tubiformis</i> Tsg.	11			
<i>Pedicularis pectinata</i> Wall.	1/13 V+-1			
<i>Pedicularis pycnantha</i> Boiss.ssp. <i>semenovii</i> Pr.	3/13 I-IV+,+	1/13 II+		
<i>Pedicularis pycnantha</i> Boiss.ssp. <i>typica</i> Pen.	2/13 +	2/13 II-V+-1		
<i>Pedicularis pyramidata</i> Royle	3/13 I+,+-1			
<i>Peganum harmala</i> L.	1/7 r			
<i>Pennisetum flaccidum</i> Griseb.	1/7 +	1/13 I+	12	
<i>Perovskia abrotanoides</i> Karel.	1/7 r	1/13 +		
<i>Physochlaina praealta</i> (D.Don)Hook.f.	1/7 +	2/13 I-IV+	2/12 +-II+	
<i>Piptatherum gracile</i> Mez	4/7 II-Vr-1, +-1	4/13 I-V+-3	3/12 I-III+-3	1/5 I1
<i>Piptatherum laterale</i> (Munr.ex Regel)Rosh.	10/13 II-Vr-2,1-2	5/13 III-V+-2,+-1	1/12 IV+-1	1/9 IV+-2
<i>Plantago himalaica</i> Pilger	1/13 +			
<i>Pleurospermum hookeri</i> C.B.C.var. <i>thomsonii</i>	1/9 1			
<i>Pleurospermum stellatum</i> Bth.var. <i>lindleyanum</i>	1/9 II1-2	1/5 II+-1		
<i>Poa attenuata</i> Trin.	5/9 IV-V+-3,1,10	5/12 +-II+-2	4/5 I-V+-2, 1	
<i>Poa</i> cf. <i>attenuata</i> Trin.	1/13 +-2	1/13 II2		
<i>Poa calliopsis</i> Litw.ex Ovcz.	11			
<i>Poa pratensis</i> L.ssp. <i>pratensis</i> Dickoré	4/13 I+,+-1			
<i>Poa pratensis</i> L.ssp. <i>pruinosa</i> (Korot.)Dickoré	1/13 +	2/13 I1,1	1/9 III1-2	1/5 IV+-1
<i>Poa sterilis</i> M.Bieb.	1/7 II1	4/13 +-III+-2	9/13 II-V+-2,+-2	9/12 I-IVr-2, 1 4/5 I-III+-2, 1 4/9 I-V+-3
<i>Poa suruana</i> Hartmann	7/13 I-V+-3,1-2			
<i>Poa tibetica</i> Munro ex Stapf	12			
<i>Polygonum cognatum</i> Meissn.	2/13 +	4/13 I+,+-1	1/12 +	5/9 +-IIIr-1
<i>Polygonum molliaeforme</i> Boiss.	2/12 I-II+-3	1/5 II1-2	1/9 +	
<i>Polygonum paronychioides</i> C.A.Mey.	1/7 I+-1	11/13 II-Vr-2,+-1	6/13 I-V+-1,+-1	
<i>Polygonum polycnemoides</i> Jb.et Sp.	6/13 III-V+-2,1-2			
<i>Polygonum rottboellioides</i> J.et Sp./ <i>polycnem.</i> J.et Sp	3/7 +, 1-2	9/13 II-V+-2,+-2	1/12 II+	
<i>Potentilla ambigua</i> Camb.	1/12 I+			
<i>Potentilla aphanes</i> Soják	1/12 I +			
<i>Potentilla argyrophylla</i> Wall.	1/12 +			

<i>Potentilla argyrophylla</i> Wall.var. <i>leucochroa</i> Hk.f.	1/13 I+	2/13 +	3/9 II-IV+-2			
<i>Potentilla bifurca</i> L.	2/7 II+, 1	1/13 2	10/12 I-V+-2, 1	5/5 II-IV+-2, 2	5/9 +-III+-3, 2, 12	
<i>Potentilla bifurca</i> L.fo. <i>monstrosa</i> Wolf*	5/13 I-IIIr-2, +					
<i>Potentilla desertorum</i> Bunge	2/13 +	2/9 I-II+				
<i>Potentilla gelida</i> C.A.Mey.	4/9 II-IV+-2					
<i>Potentilla multifida</i> L.	1/13 r	2/5 III-IV+-1	3/9 +-IV1-3, 2, 11, 12			
<i>Potentilla nivea</i> L.var. <i>himalaica</i> Kitam.	2/9 II+					
<i>Potentilla salesoviana</i> Steph.	1/13 +					
<i>Potentilla pamirica</i> Wolf	3/5 III-V+-2, +					
<i>Potentilla sericea</i> L.(inkl. <i>P.aphanes</i> Soják)	5/12 I-III+-3, +	7/9 I-V+-4, +-2, 10				
<i>Potentilla</i> sp.	2/9 I1-2, 1					
<i>Primula denticulata</i> Smith	1/13 1					
<i>Primula elliptica</i> Royle	3/13 II-V+-1, +	1/13 I+				
<i>Primula minutissima</i> Jacq.	1/9 III+-1					
<i>Primula nutans</i> J.G.Georgi	1/9 +					
<i>Primula</i> sp.	1/9 IIr					
<i>Pseudomertensia echioides</i> (Benth.)Rdl.	4/13 II-IV+-1, +	1/13 +				
<i>Psychrogeton andryaloides</i> (DC.)Nov.var. <i>andryal.</i> Gr.	8/13 I-Vr-2, +	3/13 Ir+-, +	3/12 II+-2, +			
<i>Psychrogeton andryaloides</i> Nov.var. <i>denudatus</i>	2/9 III-V+-2					
<i>Ptilotrichum canescens</i> (DC.)C.A.Mey.	1/7 1	6/12 II-Vr-2	1/5 II+			
<i>Puccinellia himalaica</i> Tzvel.	1/5 I+	1/9 1				
<i>Pulsatilla wallichiana</i> (Royle)Ulbr.	2/13 V+-2, +	1/13 I+-2				
<i>Ranunculus lobatus</i> Jacq.ex Camb.	3/9 I-III+-1					
<i>Ranunculus pulchellus</i> C.A.Mey.	2/9 +, r					
<i>Ranunculus pulchellus</i> C.A.M.var. <i>stracheyanus</i>	4/9 +-II+, +-2					
<i>Ranunculus tricuspis</i> Maxim.	11.12					
<i>Rheum spiciforme</i> Royle	1/5 IIr+-					
<i>Rheum tibeticum</i> Maxim.	1/7 +	3/12 +-IVr+-				
<i>Rheum webbianum</i> Royle	2/13 +	8/13 II-V+, r+-	1/9 I+			
<i>Rhodiola tibetica</i> (Hook.f.et Th.)Fu	1/13 Ir+-	2/13 II+	3/5 I-III+	2/9 II+-2, +, 10		
<i>Rhodiola wallichiana</i> (Hook.)S.H.Fu	3/9 IV-V+-2					
<i>Rochelia laxa</i> J.M.Johnst.	1/13 1					
<i>Rosa webbiana</i> Wall.ex Royle	2/7 r-IVr+-	3/13 +-IIr+-	1/13 +			
<i>Rosa</i> sp.	2/13 I-V+					
<i>Rosularia alpestris</i> (Kar.et Kir.)Boriss.	2/13 II-III+-1	6/13 I-V+, +-1	2/9 II-III+-1			
<i>Rubia tibetica</i> Hook.f.	1/13 +					
<i>Rumex acetosa</i> L.	2/13 I+, 1					
<i>Sagina saginoides</i> (L.)Karst.	1/13 1					
<i>Salix flabellaris</i> Andersson	1/13 +					
<i>Salix karelinii</i> Turcz.	2/13 IIr-4					
<i>Salsola jacquemontii</i> Moq.	3/12 Ir-1					
<i>Salsola tragus</i> L.	2/7 +, 1	1/12 IIr+-				
<i>Salsola</i> sp.	1/12 I+-1					
<i>Saussurea candoleana</i> (Wall.ex DC.)Clarke	1/13 +					
<i>Saussurea falconeri</i> Hook.f.	3/13 II-IV+-1, +	3/9 II-IV+-1				
<i>Saussurea glacialis</i> Herd.	1/9 II2					
<i>Saussurea glanduligera</i> Schlitz.-Bip.	1/12 I+					
<i>Saussurea gnaphalodes</i> Sch.-Bip.	4/9 II-III+-2, +					
<i>Saussurea jacea</i> (Klotzsch)Clarke	1/13 +					
<i>Saussurea nana</i> (Pamp.)Pamp.	3/9 IV+-2, 1, 10	2/5 III-V+-1				
<i>Saussurea stoliczkae</i> C.B. Clarke	2/9 II+					
<i>Saussurea taraxacifolia</i> Wall.var. <i>depressa</i>	1/9 1					
<i>Saxifraga cernua</i> L.fo. <i>bulbillosa</i> Engl.et Irm.	1/9 +					
<i>Saxifraga flagellaris</i> Wld.ssp. <i>crassiflagellata</i>	4/9 I-V+-2					
<i>Saxifraga hirculoides</i> Decne.	2/9 II+, +					
<i>Saxifraga jacquemontiana</i> Dne.var. <i>stella-aurea</i>	1/9 II1					
<i>Scorzonera virgata</i> DC.	12/13 I-V+-1, +-1	7/13 III-V+-1, +-1				
<i>Scrophularia dentata</i> Royle	3/12 II-III+-2, 1					
<i>Scrophularia koelzii</i> Penn.	1/13 II+-1					
<i>Scrophularia nudata</i> Pennell	5/13 +-II+-1, +					
<i>Selinum papyraceum</i> C.B. Clarke	2/13 IV1, +					
<i>Semenovia lasiocarpa</i> (Boiss.)Manden.	2/7 I+-2, +	8/13 +-IIIr-2, r+-	1/12 II+-1			
<i>Senecio dubius</i> Ledeb.	2/13 +-Ir	1/12 IV+				
<i>Senecio krascheninnikovii</i> Schischk.	1/7 +					
<i>Senecio</i> sp.	1/12 I+					
<i>Sibbaldia cuneata</i> Kunze	2/13 +-2					
<i>Sibbaldia cuneata</i> Kze.var. <i>micrantha</i> RRS.	3/9 II-III+-2	1/12 +				
<i>Sibbaldia tetrandra</i> Bunge	2/9 +-II+-1, 10					
<i>Silene gonosperma</i> Bocq.ssp. <i>himalayensis</i> Bq.	6/9 I-IIr-1, +	1/13 +	1/5 I+			
<i>Silene moorcroftiana</i> Wall.	2/7 +, +	9/13 +-V+-2, +-1	1/13 II+	4/12 II+-1, r	1/5 I1	1/9 II+
<i>Silene tenuis</i> Willd.	2/13 II+, +	1/9 I+				
<i>Silene vulgaris</i> (Moench)Garcke s.l.	1/5 I+					
<i>Sisymbrium brassiciforme</i> C.A.Mey.	1/7 r	1/13 Ir	2/13 I-IIIr-1	1/12 III+-3		

<i>Stachys tibetica</i> Vatke	5/7 III+-2, +	5/13 III-Vr-3,+2	1/12 I2		
<i>Stellaria montioides</i> (Edg.et Hook.f.)S.A.Ghaz.	1/12 +				
<i>Stellaria cf. montioides</i> Ghazanf.	1/13 +	1/5 I2	3/9 III+-2,1		
<i>Stellaria cf. persica</i> Boiss.	2/5 II-IV+-1	4/9 II-IIIr-1,2			
<i>Stipa breviflora</i> Griseb.	1/7 2	4/12 +-V1-3	1/5 IV1		
<i>Stipa caucasica</i> Schmalh.ssp. <i>caucasica</i>	1/13 II+-1				
<i>Stipa caucasica</i> Schmalh.ssp. <i>glareosa</i> Tzvel.	1/13 I1	1/5 II+	5/12 I-Vr-3		
<i>Stipa himalaica</i> Roshev.	4/7 III-IVr-2, +	2/13 IIr-2			
<i>Stipa cf. himalaica</i> Roshev.	1/12 II+-1				
<i>Stipa orientalis</i> Trin.	7/7 II-IVr-2, +-2	4/13 III-V+-2,+2	2/12 +-II+-1		
<i>Stipa pennata</i> L.ssp. <i>kirghisorum</i> (Smirn.)H.Fr.	4/13 I-III+-1,1-3	1/13 II+			
<i>Stipa purpurea</i> Griseb.	1/12 IV+-3				
<i>Stipa roborovskyi</i> Rosh.	2/12 +-V+-1	12			
<i>Stipa subsessiliflora</i> Roshev.	1/12 II+-1				
<i>Stipa tianschanica</i> Roshev.	1/13 I+				
<i>Suaeda olufsenii</i> Pauls.	12				
<i>Swertia thomsonii</i> Clarke	1/13 +				
<i>Tanacetum artemisioides</i> Schultz-Bip.	2/13 III2,2				
<i>Tanacetum fruticosum</i> Ledeb.	5/7 II-Vr-3, +-2	3/13 III-V+-3,+	1/13 IIr	5/12 II-V+-3	
<i>Tanacetum longifolium</i> Wall.ex DC.	2/13 I+,1	1/13 I+			
<i>Tanacetum senecionis</i> DC.	4/13 V+-1,+2	2/13 Ir+	2/9 +-II1		
<i>Tanacetum tibeticum</i> Hook.f.et Th.	3/5 I-III+-1	3/12 +-IIr-1	3/9 I-III+-1		
<i>Taraxacum cf. bicolor</i> DC.	1/13 +				
<i>Taraxacum leucanthum</i> Ledeb.	1/9 1,11				
<i>Taraxacum cf. pseudo-stenolepium</i> v.Soest	2/13 r+				
<i>Taraxacum</i> sp.	5/13 I-IVr-+, +	5/13 I-IIIr-1,+	2/12 +-I+	3/9 +-II+,+,12	1/5 II+
<i>Thalictrum alpinum</i> L.var. <i>microphyllum</i> Hd.-Mz.	5/9 I-III+-2,+,11				
<i>Thalictrum foetidum</i> L.	3/13 II+,+	2/13 I-II+	1/12 I+		
<i>Thermopsis inflata</i> Camb.	4/12 +-IV+-3,1				
<i>Thesium hookeri</i> Hedrych	3/13 Ir-+,+	2/13 +-Ir	1/5 I+	2/12 I-II+	
<i>Thylacospermum caespitosum</i> Schischk.	2/5 I-IV+-1	3/9 I-Vr-1,10			
<i>Thymus linearis</i> Benth.ssp. <i>linearis</i> J alas	5/13 I-IVr-2	5/13 I-III+-2,1-3	1/12 +		
<i>Torularia cf. humilis</i> (Mey.)O.E.Schulz	1/12 I+				
<i>Trachydium roylei</i> Lindl.	1/9 IIIr-2				
<i>Tragopogon dubius</i> Scop.	1/13 +				
<i>Trigonella</i> sp.	1/13 +				
<i>Trisetum spicatum</i> (L.)Richt.ssp. <i>himalaicum</i>	6/9 I-V+-2	1/12 +			
<i>Urtica hyperborea</i> Jacq.	3/9 I-IIr+	2/5 II+, +	1/12 III+		
<i>Valeriana clarkei</i> Briq.	1/13 Ir				
<i>Valeriana himalayana</i> Grub.	1/12 I+				
<i>Verbascum thapsus</i> L.	2/13 IIr-+, +				
<i>Verbascum cf. thapsus</i> L.	1/13 I+				
<i>Veronica biloba</i> L.	7/13 III-IV1-2,+2	5/13 I-III+-2,1-2			
<i>Veronica lanosa</i> Royle ex Benth.	2/13 II+-1, 2	1/13 +			
<i>Veronica uncinata</i> Pennell	1/12 +				
<i>Viola kunawarensis</i> Royle	2/13 II+, +				
<i>Viola rupestris</i> F.W.Schm.	1/13 +-1				
<i>Viola</i> sp.	1/12 +				
<i>Waldheimia nivea</i> (Hook.f.et Th.)Regel	1/9 IIIr				
<i>Waldheimia tridactylites</i> Kar. et Kir.	4/9 +-III+-2				
<i>Youngia tenuifolia</i> B.et St.ssp. <i>diversifolia</i> B.& S.	1/7 +	1/12 I+			

11. Fotographic illustrations to the summarizing survey

Fotos (1–30) with the corresponding numbers of field trip-areas (1–20)



Foto 1: Conifers (*Abies pindrow*, *Picea smithiana*) and snow-deformed *Betula utilis* in a cluster of *Bergenia stracheyi*; SW of Zoji La (Kashmir), about 3100 m a.s.l. 1



Foto 2: Mouth of Chellong River, 4c (into Suru River, at the back) near Panikhar; foreground: *Artemisia brevifolia*-steppe; plaine: grain-fields (late of August). 4a



Foto 3: View (from 4160 m a.s.l.) over the valley E of Sanku, 4b; background: Valley of Suru River, 4a; foreground right: *Salix karelinii*.



Foto 4: E – W-extending Valley of Suru River (Sanmodangsa = Gulmatungo), about 3900 m a.s.l., looking from W; right side: N-faces of the Himalaya Range. 4d



Foto 5: *Juniperus communis* ssp. *alpina*; Valley of Suru River near Sanmodangsa (Gulmatungo), ca. 3900 m a.s.l. View westwards. **4d**



Foto 6: View from N (W of Karsha Gompa) on the plain of Padum (background, ca. 3500 m a.s.l.), in front of that: river-bed of Doda short of confluence to Zaskar River. **6**



Foto 7: Landscape of semi-desert between Namika La and Mulbekh; foreground: *Morina coulteriana*, about 3750 m a.s.l. View looking westwards. **7a**



Foto 8: Upper monastery (Gandentse Gompa) of Mulbekh in a semi-desert like area; view from N. **7a**



Foto 9: Gorge in desert along the Indus River, about 20 km E of Khalsi, ca. 3000 m a.s.l.
View westwards along the river. 9



Foto 10: Oasis of Saspul (36 km E of Khalsi) within the desert of Indus River, looking from W; left side:
Gate- (Khagan) Tschörten. 9



Foto 11: Lardo Brok: view looking northwards from 4500 m a.s.l. (*Aconogonon tortuosum* – *Nepeta glutinosa* community) on the desert along the River Indus (ca. 3100 m a.s.l.).



Foto 12: View looking from W towards the grain-fields of Yangtang in the midst of subalpine desert, about 3700 m a.s.l.; on the right: Indus Molasse at the contact with granite of the Ladakh Range (left). 10



Foto 13: Hemis Shukpachan: a stand of older *Juniperus semiglobosa*, about 3700 m a.s.l. 10



Foto 14: Subalpine desert in which *Tanacetum fruticosum* dominates, N above Likir Gompa, 3800 m a.s.l.; stand of Nr. 13 (Tab. 1, 1995). **10**



Foto 15: Cultivations in the Valley of Nie (northern side valley of the Indus River) N of Basgo. **11**



Foto 16: *Cremanthodium ellisii* in highalpine turf community of *Poa attenuata* and *Potentilla pamirica*, S-face of Khardung La, 5100 m a.s.l. **12**



Foto 17: *Waldheimia nivea*, S-slope of Khardung La, about 4850 m a.s.l. **12**



Foto 18: *Saussurea stoliczkai* in a *Poa attenuata*–*Potentilla pamirica* community, S- slope of Khardung La, about 4800 m a.s.l. 12



Foto 19: *Saussurea glacialis* in a *Poa attenuata*–*Potentilla pamirica*-turf, S-slope of Khardung La, 5000 m a.s.l. 12



Foto 20: *Nepeta longibracteata*, N facing slope of Kanda La, 4850 m a.s.l.

13



Foto 21: Cultivated fields below Hemis village; background (NW facing slopes): subalpine desert with stand of
Nr. 24 (Tab.1, 1995).

13



Foto 22: Nimaling: highest turf community of *Festuca tibetica* and *Arenaria bryophylla*, 5150 m a.s.l., view looking towards NW: Markha Valley and Zaskar Mountains. 14



Foto 23: *Pleurospermum stellatum* var. *lindleyanum* in turf community of *Poa attenuata* and *Potentilla pamirica*, N of Taglang La, 5100 m a.s.l. 15



Foto 24: *Caragana versicolor* grown through by *Elymus jacquemontii*; Debring, SE of Taglang La, 4800 – 4850 m a.s.l. **16**



Foto 25: Caragana-vegetation W above Norbo (Rupshu), about 4900 m a.s.l.; in the back-ground (WSW): Zaskar Mountains. **16**



Foto 26: *Artemisia macrocephala* near the lakeside of Tso Kar,
about 4600 m a.s.l. 16



Foto 27: Nuruchan, S of Tso Kar: grazing Yak herd, ca. 4700 m a.s.l. 16



Foto 28: Valley of Sumkhel Lungpa N of Pang (Rupshu); foreground: desert-steppe, on the left with *Caragana versicolor*, ca. 4500 m a.s.l. View eastwards. **16**



Foto 29: *Heteropappus semiprostratus*, in alpine steppe of *Potentilla bifurca* and *Artemisia gmelinii* N of Chang La, 4710 m a.s.l. **20**



Foto 30: Tso Moriri, 4542 m a.s.l.; the whole southern part within alpine desert.
(Aquarell v. *H. Hartmann*)

18

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Maps: - Operational Navigation Chart 1:1.000.000 ONC G – 7 (1980).

- India and Pakistan 1: 250.000 AMS NI 43-7 Kargil, NI 43-8 Leh, NI 43-11 Anantnag, NI 43-12 Martselang, NI 43-16 Palampur, NI 44-5 Shyok, NI 44-9 Pangong Tso, NI 44-13 Tso Morari.

Appendix 1: Places and date of study trips in Ladakh

The following list gives a general view of the excursion areas which were visited in Ladakh in the years 1976 to 1997. The list indicates where, when and for how long field work was done in the different regions of the country.

1976

15. – 22. 7.: (1, 2, 3, 7) Sonamarg – Zoji La – Matayan – Dras – Yasghun – Kargil – Mulbekh – Namika La
23. – 31. 7.: (8, 9) Fotu La – Lamayuru – Khalsi – Saspul – Alchi, Alchi Brok – Leh
1. – 14. 8.: (12, 13) Leh area – Vy. of Matho – Matho Phu – Indus Vy. up to Hemis
15. – 19. 8.: (4, 7) Leh – Mulbekh – Kargil – Sanku – Area of Sanku
20. – 25. 8.: (4) Vy. E of Kartse – Sanku – Panikhar and Vy. of Chellong River
26. – 31. 8.: (4) Panikhar – Sanmodangsa (Gulmatungo)
1. – 4. 9.: (2, 3, 4) Area of Panikhar – Vy. of Chellong River – Kargil – Dras – Srinagar

1979

14. – 22. 7.: (12, 13) Area of Leh – Vy. S of Stok – Area of Stok Phu
23. – 31. 7.: (13, 14) Stok La – Rumbak – Yurutse – Kanda La – Vy. of Indus – Leh
1. – 9. 8.: (3, 7) Mulbekh – Vy. of Wakha Chu SE Gel – Area of Kargil
10. – 22. 8.: (6) Kargil – Juldo (Rangdum) – Tungri – Ating – Vy. of Dzongkhul Gumpa – Area of Tungri – Sani – Padum – Bardan Gumpa – Karsha
23. – 31. 8.: (4, 5) Tungri – Pensi La, entire area of Pensi La – Sanku – Kargil
1. 9.: Kargil – Srinagar

1987

12. – 17. 7.: (3, 12) Srinagar – Kargil – Leh
18. – 23. 7.: (10) Leh – Pobe La – Sumdo – Charatse La – Yangtang – Vy. of Rizong Gumpa – Sermanchan La – Hemis Shukpachan – Meptek La – Ang – Tingsmogang – Nurla – Leh
24. – 28. 7.: (12) Area of Leh – Sabu – Vy. of Indus
29. 7. – 3. 8.: (11, 13, 14) Spituk – Zinchen – Rumbak – Kanda La – Shingo – Skiu – Markha – Tchatchutse (E Hankar)
4. – 10. 8.: (13, 14) Entire area of Nimaling – Kongmaru La (N) – Chukirmo – Shang – Hemis – Leh
11. – 16. 8.: (2, 12) Leh – Vy. of Indus – Chemre – Sakti – Kargil – Dras – Zoji La – Srinagar

1992

9. – 23. 7.: (12) Leh area: Sabu – Spituk – Choglamsar – Tisseru etc.
24. 7. – 4. 8.: (12, 13, 15) Taglang La – Leh – Choglamsar – Shey – Phiyang – Karu – Hemis – Götsang

5. – 9. 8.: **(15)** Leh – Rumtse (N of Taglang La) – Taglang La – Tsakenama
10. – 12. 8.: **(13)** Leh (Indus Vy.) – Area of Stok
13. – 16. 8.: **(16)** Taglang La – Debring (S of Taglang La, Rupshu) – Rumtse – Leh
17. – 28. 8.: **(9, 11, 12, 15)** Leh – Phiyang – Basgo – Ladakh Konka – Spituk area – Upshi –
Rumtse – Likir area – Saspul – Alchi
8. 9.: on the top of Rohtang Pass (Himachal Pradesh)

1995

28. 7. – 3. 8.: **(11, 12, 13)** Leh area – Phiyang – Matho – Hemis – Götsang area
4. – 10. 8.: **(19)** Panamik (Nubra Vy.) – Area of Khardung – Khardung La – Leh
11. – 20. 8.: **(11, 12)** Leh area – Spituk – Vy. of Nie (N Basgo) – S of Khardung La –
South Pulla – Gangles – Gompa village – Sankar
21. – 27. 8.: **(16)** Taglang La – Tso Kar – Nuruchan – More Plain – Pang –
Lachalung La – Norbo – Taglang La – Leh
28. 8. – 2. 9.: **(12)** Leh area – Area of River Indus up to Stakna

1997

1. – 11. 8.: **(11, 12)** Leh area – Sabu (towards Digar La) – Umla
12. – 18. 8.: **(20)** Chang La – Darbuk – Tangtse – Muglib – Pangong Tso – Vy. SE
Muglib – Darbuk – Vy. SE Tsoltak (N of Chang La) – Tsoltak –
Chang La – Leh
19. – 22. 8.: **(12, 13)** Stok – Nang – Leh
23. – 29. 8.: **(17, 18)** Upshi – Mahe – Sumdo – Kiagar La – Karzok near Tso Moriri –
Vy. W of Karzok – Karzok Phu – Kiagar Tso – Kiagar La – Sumdo-
Chumatang – Hemya – Upshi – Leh
30. 8. – 8. 9.: **(10, 11, 12)** Leh – Phiyang towards Lasirmu La – Hemis Shukpachan – Zingrul
(S of Chang La) – Sakti – Leh

(1– 20) = Areas of field trips

Vy. = Valley

Rumbak = Place (underlined) with a stay of at least one to several nights

Appendix 2: The most used field- and locality-names in alphabetical order (in brackets the corresponding field numbers)

Alchi / -Brok (9)	Likir (10)	Sanmodangsa (4d)
Ang (10)	Mahe (17)	Sapi – Shergol (7a)
Baralacha La (Lahul)	Markha (14)	Saspul (9)
Bardan (6)	Martselang (13)	Sermanchan La (10)
Basgo (11)	Matayan (2)	Shagar (6)
Bhaga River (Lahul)	Matho / Phu (13)	Shang (13)
Chaluk (14)	Meptek La (10)	Shergol (7a)
Chang La (12)	Miru (15)	Shey (12)
Changspa (12)	More Plain (16)	Shingo (14)
Charatse La (10)	Muglib (20)	Shyok Vy. (19)
Chellong River (4c)	Mulbekh (7a)	Skiu (14)
Choglamsar (12)	Namika La (7a)	Sonamarg (W of 1)
Darbuk (20)	Nang (12)	Spituk (12)
Darcha (Lahul)	Nie (11)	Stakna (13)
Debring (16)	Nimaling (14)	Stok / Phu / La (13)
Digar Phu / La (12)	Nimu (11)	Sumdo (17)
Dras (2)	Norbo (16)	Suru Vy. (4)
Dzongkhul Gompa. (6)	Nubra Vy. (19)	Taglang La (15, 16)
Fotu La (8a)	Padum (6)	Tangtse (20)
Ganges (12)	Panamik (19)	Tchatchutse (14)
Gel (7b)	Pangong Tso (20)	Tikse (12)
Götsang (13)	Panikhar (4a)	Tingsmogang (10)
Hemis (13)	Parkutse (4d)	Tirdik (12)
Hemis Shukpachan (10)	Pensi La (5)	Tisseru near Leh (12)
Hemya (17)	Phiyang (11)	Tso Kar (16)
Kanda La (13, 14)	Pobe La (10)	Tso Moriri (18)
Kargil (3)	Rangdum (4d)	Tsoltak (20)
Karsha (6)	Rizong Riv./ Gompa. (9)	Tungri (6)
Kartse (4b)	Rohtang Pass (Him.Prad.)	Umla (11)
Karzok (18)	Ronga La (11)	Upshi (17)
Khalsi (9)	Rumbak (13)	Wakha Vy./ Chu (7b)
Khardung / La (12, 19)	Rumtse (15)	Yangtang (10)
Kiagar La / -Tso (17, 18)	Rupshu (16)	Yasghun (2)
Kongmaru La (13, 14)	Sabu (12)	Yurutse (13)
Lachalung La (16)	Sakti (12)	Zanskar (6)
Ladakh Konka (11)	Sani (6)	Zinchen (11)
Lamayuru (8b)	Sankar (12)	Zingrul (12)
Leh (12)	Sanku (4a)	Zoji La (1)