

SOME PLANT COMMUNITIES OF THE BOL'SAJA ČEREMŠANA VALLEY, BARGUZINSKIJ RANGE

J. Danihelka¹ and M. Chytrý²

¹Administration of the Protected Landscape Area Pálava, Náměstí 32, CZ-692 01 Mikulov, Czech Republic²; Department of Systematic Botany and Geobotany, Masaryk University, Kotlářská 2, CZ-611 37 Brno, Czech Republic.

Abstract: Selected vegetation types of the Bol'saja Čeremšana valley, Barguzinskij Range, East Siberia, are described using the Braun-Blanquet approach. A total of 21 communities are distinguished which comprise 4 tundra communities, 1 scree, 6 grassland and tall-forb, 5 sedge-fen and mire, 2 shrub and 3 forest communities. Of these, two communities, *Salici turzaninowii-Sibbaldietum procumbentis* and *Artemisio lagocephalae-Dryopteridetum fragrantis* are formally described as new associations. These communities are documented by 141 relevés. Their ecology and syntaxonomy are briefly discussed.

Key-words: Vegetation description, syntaxonomy, Braun-Blanquet approach, Lake Baikal, East Siberia.

Introduction

This paper summarizes a part of the results of the project organized by the International Center for Research and Conservation of Siberia, Praha, aimed at syntaxonomical treatment of vegetation of the Zabajkal'skij Nature National Park, using the Braun-Blanquet approach. This project was initiated in 1991 as a part of the Czech biological expeditions to this area. Vegetation research mainly focused on three territories: Svjatoj Nos peninsula (Chytrý and Pešout 1992, Chytrý et al. 1993), Bol'šoj Čivyrkuj valley (Chytrý et al. 1995) and the Bol'saja Čeremšana valley which is treated in this paper. It makes use of the phytosociological material collected in July-August 1992 during the expedition to the southern part of the Barguzinskij Range.

Acknowledgments: Thanks are due to Antonín Vězda (Brno) for the determination of lichens and a part of the moss specimens, and Ivan Novotný (Brno) for the determination of bryophytes. We are obliged to

Kamila Chaloupková (Praha) for her support during the fieldwork, as well as all the other Czech and Russian friends and the Administration of the Zabajkal'skij Nature National Park who made this expedition possible.

Area under study

The Bol'saja Čeremšana valley is situated in the southern part of the Barguzinskij Range, draining its western slopes. The mouth of the river into Lake Baikal is located at ca 54° 01' N and 109° 26' E. The valley is running approximately in E-W direction, reaching a length of ca 22 km.

The upper part of the valley, from the source of the Bol' Čeremšana river (ca. 1750 m a.s.l.) to the confluence of the Pravaja Bol'saja Čeremšana and Levaja Bol'saja Čeremšana rivers (894.5 m a.s.l.), is ca. 4 km long. Large cirques in the spring area with mountain lakes in the bottom part suddenly close into a narrow valley. Its lower part, from the confluence of the Pravaja Bol'saja Čeremšana and Levaja Bol'saja Čeremšana rivers (894.5 m a.s.l.) to the mouth is ca. 18 km long, V-shaped and relatively narrow. The alluvium of the river is poorly developed, reaching the maximum breadth of ca. 1.2 km near the mouth. At some places, the lowest river terrace is situated high above the river. The shore line of Lake Baikal near the mouth is skirted by a stone bar, which divides a small wetland from the lake.

The river has several feeders from both sides. Valley of the Prjamoj creek, the last right feeder, has a similar character, including a large cirque with a mountain lake at the end of the valley.

The bedrock of the area under study is formed of the nutrient-poor rocks of the crystalline complex, especially granites. The bottom of the valley 0-15 km from the mouth is filled with Quarternary deposits: gravels and sands (Davydov et al. 1980, see also Danihelka and Chaloupková, this volume).

The altitudinal vegetation pattern with subalpine vegetation types descending to the lake shores, described by Tjulina (1967, 1976) as typical of the North-eastern Baikal area, was not observed. Small area near the mouth is occupied by a wetland in which sedge fens and scattered pools are found. On the shore stone bar along the greater part of the shore line, no vegetation cover is developed towards the lake. In some places, there is a strong layer of logs, stranded from the lake. The other wind-protected side of the stone bar, sloping down towards a wetland, is covered by several plant communities. The main ecological influences are the distance of the groundwater level from the surface and the wind. The highest strip of the bar is settled by a *Calamagrostis langsdorfii* meadow with shrubs in some locations. Moving towards the wetland, the dominance of *Carex*

juncella increases, and in the shallow lakes of the wetland, *Carex rhynchophylla* appears. The described situation is shown in Fig. 1.

Slopes and old river terraces on the bottom of the valley are covered with the taiga forest with *Abies sibirica*, *Pinus sibirica*, *Larix sibirica* and *Pinus sylvestris*. On the south-facing slopes which were destroyed by fire, probably *Pinus sylvestris* used to be the dominant tree. In the alluvium of the river, some shrub communities and a remarkable alluvial forest of *Chosenia arbutifolia* and *Salix vorida* were found. The intermittent channels and fresh sandy and gravelly deposits possess their typical vegetation with *Salix vorida*. Tall-forb vegetation is found along the river and the creeks.

The alpine timberline is situated at ca. 1000-1200 m a.s.l., with some differences depending on the aspect and steepness of slopes and soil conditions. The subalpine belt is formed by *Pinus pumila* krummholz, alternating with block fields. Along the creeks and at protected sites, stands of shrubby birches (*Betula divaricata*) and willows are found, together with tall-forb communities, alpine meadows and short grasslands. The alpine belt, beginning at approximately 1600 a.s.l., is represented by short grasslands of several types, screes and snow patches. Near the mountain lake in the Prjamoj valley, mire vegetation is developed.

Methods

Field work was carried out by the senior author in the Bol'saja Čeremšana valley and the valley of its right feeder, the Prjamoj creek, during the expedition in July-August 1992. Floristic study of the territory was carried out during this expedition too (Danihelka and Chaloupková, this volume).

In vegetation description, classic methods of the Zürich-Montpellier approach (Braun-Blanquet 1964, Westhoff and van der Maarel 1978) were used. In the field, relevés were taken using the 7-degree scale of abundance and dominance (-, +, 1, 2, 3, 4, 5). Crustaceous and epiphytic lichens and bryophytes on the bark of trees were omitted in the relevés. Because of a shortage of time, it was impossible to study all the types of plant communities occurring in the area under study, and only chosen community types were described.

After the removal of 2 relevés of unstable post-fire communities, 141 relevés were used for synthesis. These relevés were grouped with the other relevés from the North-east Baikal area (mainly Svjatoj Nos peninsula, Bol'soj Čivyrkuj valley), taken by O.A. Anenonov, M. Chytrý, J. Danihelka and P. Pešout in 1991-1993, and divided preliminarily into physiognomical groups (e.g. tundras, meadows and tall-forb communities, forests etc.). These groups were numerically classified using the divisive

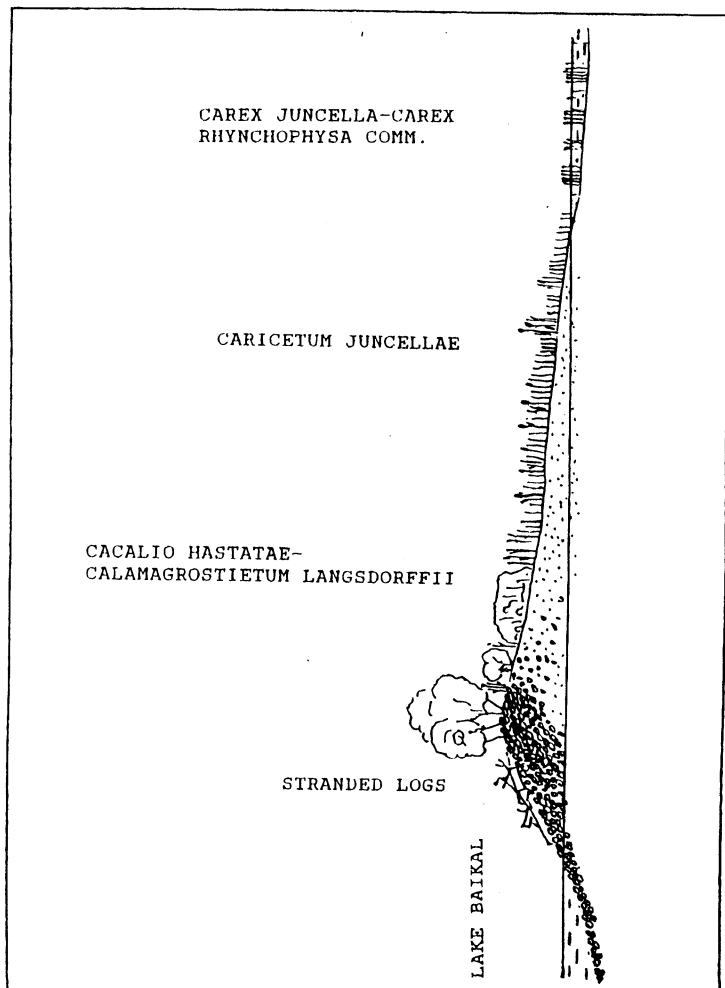


Fig. 1: The shore of Lake Baikal and its vegetation near the mouth of the Bol'shaja Čeremšana river.

algorithm of the program TWINSpan (Hill 1979). Final classification is essentially based on the groups produced by this analysis. However, particular groups of relevés on which the accepted classification is based were extracted from different hierarchical classification levels in order to reach ecologically interpretable groups. This way, classification into community types was performed. Particular community types were compared with phytosociological literature and those which belonged to an earlier validly described association (sensu Barkman et al. 1986) were labelled with the name of this association. Two new associations were described for community types distinctly differentiated from the other vegetation types in the study area, and found also in other areas outside the Bol'shaja Čeremšana valley. The others are called by the non-committal term "community", conceived here as a vegetation unit on roughly the same level as an association, using names of one or two typical species. The "community" names for the analogous vegetation units are usually the same as in Chytrý and Pešout (1992) and Chytrý et al. (1993, 1995).

Names of vascular plants agree with "Flora Sibiri" (Krasnoborov 1988, Krasnoborov & Malyšev 1992, Malyšev & Peškova 1987, 1990, 1993, Peškova and Malyšev 1990, Položij and Malyšev 1988), and with Malyšev and Peškova (1979) for the families that are not yet covered by this compendium. Nomenclatures of bryophytes and lichens follow Bardunov (1992) and Santesson (1984), respectively.

Plant community survey

Tundra communities

Salici tureczaninowii-Sibbaldietum procumbentis ass. nova hoc loco (App. 1, rel. 1-4)

Nomenclatural type relevé: App. 1, rel. 3 (holotypus hoc loco). Besides the relevés in this paper the original diagnosis also includes the relevés 12-17 in tab. 1 in Chytrý et al. (1995).

This is a snowbed community occurring on gentle slopes and well-drained plateaus at sites protected from strong winds. The long-lasting snow cover is the dominant ecological factor affecting this community. After the snow has melted, the soil usually dries-out during the summer. This community is also documented from the spring area of the Bol'shoj Čivyrkuj river (Chytrý et al. 1995). Similar communities were described by Tjulina (1976) from the Šumilicha valley in the Barguzinskij Range. Species composition of snowbed communities described from Europe and the Arctic (see Chytrý et al. 1995 for references) differs from snowbed communities of the Barguzinskij Range.

Ranunculus altaicus-*Angelica decurrens* community

This snowbed community was found at one site in a shady and shallow depression. The main ecological influences, forming this vegetation type, are the extremely high and long-lasting snow cover, together with a poorly drained and moist soil. Similar community is described in Tjulina (1976) from the Šumilicha valley. Syntaxonomical status of this vegetation is not clear. Floristic composition is documented by the following relevé:

Valley of the Čeremšanye lakes, 10.1 km ENE of the confluence of the Pravaja Bol'. Čeremšana and Levaja Bol'. Čeremšana rivers, area 4 m², plane, 1660 m a.s.l., E₁=50 %, E₀=20 %, 7.8.1992.

E₁: *Ranunculus altaicus* 3, *Angelica decurrens* 2, *Poa alpigena* 1, *Epilobium anagallidifolium* 1, *Trisetum altaicum* +, *Sibbaldia procumbens* +, *Salix turczaninowii* +, *Geranium albiflorum* +, *Carex bipartita* +;

E₀: *Brachythecium* sp. 2, *Polytrichum juniperinum* 2, *Bryum* sp. 1, *Tortula* sp. +.

Anemonastro sibiricae-Festucetum ovinae Chytrý, Pešout et Anenchonov 1993 (App. 1, rel. 5-25)

This short-grassland vegetation type occurs at sites that are comparatively well protected from the influence of strong winds and covered with snow in winter. Soils of these sites become drier during the summer. A variant with chamaephytes, e.g. *Vaccinium myrtillus*, usually develops under more extreme ecological conditions on stabilized screes. At some well-protected sites, a loose shrub layer may be developed, consisting of *Betula nana* ssp. *exilis* (transitions to *Cladonia stellaris*-*Betuletum exilis*, rel. 21-22), *B. divaricata* (transitions to *Pleurozium schreberi*-*Betula divaricata* community, rel. 23-24) or *Juniperus sibirica* (transitions to *Bergenia crassifolia*-*Juniperus sibirica* community, rel. 25) - see Chytrý et al. (1995). *Anemonastro sibiricae-Festucetum ovinae* is also known from Svjatoj Nos peninsula (Chytrý et al. 1993) and the Bol'šoj Čivyrkuj valley (Chytrý et al. 1995). Similar communities are described by Tjulina (1976) and Moložnikov (1986). This community belongs to the alliance *Anemonastro sibiricae-Festucion ovinae* Chytrý, Pešout and Anenchonov 1993.

Nardosmia saxatilis-Festuca ovina community (App. 1, rel. 26-30)

This is a vegetation type on steep, from strong winds relatively well protected slopes of the alpine belt. The snow cover is not blown away by the wind and ensures a sufficient water supply until the early summer. This community consist of grasses, hemicryptophytes, lichens and mosses; no chamaephytes occur here. It was only found at one site in the upper part of the Prjamoj valley. Similar communities are not known to the authors of

this paper. Classification of this community to higher syntaxa is under question.

Communities of screes and block fields

Artemisia lagocephalae-Dryopteridetum fragrantis ass. nova hoc loco (App. 1, rel.31-32)

Nomenclatural type relevé: App. 1, rel. 31 (holotypus hoc loco). Besides the relevés in this paper the original diagnosis also includes the relevés 41-43 in tab. 1 in Chytrý et al. (1995).

This species-poor community occurs only on screes of the alpine belt, making use of the soil-filled crevices between particular boulders. There are specific ecological conditions concerning the microclimate and the water supply. This community is reported from the Bol'šoj Čivyrkuj valley (Chytrý et al. 1995). Questions concerning the syntaxonomical position of this community have not yet been solved.

Grasslands and tall-forb communities

Pulsatilla patens-Antennaria dioica community (App. 2, rel. 1-2)

This short grassland was recorded at one site on a steep and dry east-facing slope near the top of a mountain at approximately 1150 m a.s.l. Because of the exposed location, neither tree layer nor shrub layer are developed and a small island of non-forest vegetation is formed. Taking into account the lack of reference phytosociological material, no comparison and syntaxonomical evaluation is possible.

Cacalia hastatae-Calamagrostietum langsdorffii Mirkin in Mirkin et al. 1992 (App. 2., rel. 3-9)

A community covering slopes of the shore stone bar towards the wetland and a small rise near the estuary of the river, was identified with this association. The soil, fixing particular stones, is sandy. The water table is far from the surface, having no direct influence on the plant community. The relative paucity of species in some relevés of this community is probably caused by the competitive influence of *Calamagrostis langsdorffii* that produces a large amount of litter covering the soil surface. At some sites, the shrub layer of a high cover is developed. This association is known from the Middle Lena valley in Olekminskij District, Yakutia (Mirkin et al. 1992) and the Bol'šoj Čivyrkuj valley (Chytrý et al. 1995). It belongs to the alliance *Calamagrostion langsdorffii* Achtjamov, Mirkin and Urazmetov 1985.

Vicia nervata-Poa sibirica community (App. 2, rel. 10-14)

This is a meadow community of the mountain (-subalpine) belt in 1000-1350 m a.s.l. These natural meadows occur in small non forest patches bounded by forest, replacing forest at sites where some ecological

influences, e.g. very steep slopes or avalanches, make its existence impossible. Most of the tall forbs and chamaephytes are not found in this community. Syntaxonomical relations of this community need further study.

Pteridium aquilinum-Aconitum rubicundum community (App. 2, rel. 15)

This vegetation type was found in a narrow V-shaped valley of a mountain creek at approximately 1100 m a.s.l. The community is, through its species suite, closely related to the alpine meadows with tall forbs. It is related to *Pteridium aquilinum-Bergenia crassifolia* community from Svjatoj Nos peninsula (Chytrý et al. 1993) and the Bol'šoj Čivyrkuj valley (Chytrý et al. 1995). It belongs to the order *Trollio-Crepidetalia sibiricae* Guinochet per Chytrý, Pešout et Anenchonov 1993, for its closer syntaxonomical evaluation, however, more data are needed.

Aconito rubicundi-Salicetum krylovii Chytrý, Anenchonov et Danihelka 1995 (App. 2, rel. 16-28)

Tall-forb vegetation along creeks in the subalpine belt is included into this association. The habitats are well-protected from strong winds, have a very good water supply and, evidently, a high snow cover in winter. This community is also reported from the Bol'šoj Čivyrkuj valley (Chytrý et al. 1995). Analogous stands occur in the Šumilicha valley, too (Tjulina 1976). Vicariant community types were described by Žitluchina and Oniščenko (1987) and Žitluchina (1989) from the West Sayan Mts. These communities may be classified into the order *Trollio-Crepidetalia sibiricae* Guinochet per Chytrý, Pešout et Anenchonov 1993.

Aquilegio glandulosae-Geranium albiflori Chytrý, Anenchonov et Danihelka 1995 (App. 2, rel. 29-45)

This association comprises alpine meadows on bottoms of mountain valleys and tall-forb vegetation along creeks in the subalpine belt. The influence of ground water might occur in shallow depressions, causing some changes in species composition. Stress caused by the effects of strong winds is eliminated by leeward situation of the habitats, which are also protected by a high snow cover in winter. Vegetation of this community is reported from the subalpine belt of the Bol'šoj Čivyrkuj valley (Chytrý et al. 1995). This community belongs to the order *Trollio-Crepidetalia sibiricae* Guinochet ex Chytrý, Pešout et Anenchonov 1993.

Sedge-fen and mire communities

Carex canescens-Equisetum fluviatile community (App. 3, rel. 1-5)

A community of wet and intermittently flooded meadows, developed in an old river bed filled with sand and gravel. However, there is no disturbing

influence of the current during the floods. Similar communities have not been described from Siberia (see Korotkov et al. 1991). Syntaxonomical status of this community is transitional between *Equisetum fluviatile* Steffen 1931 and the communities of the alliance *Calamagrostion langsdorffii* Achtjamov, Mirkin et Urazmetov 1985.

Caricetum juncellae Mirkin, Gogoleva et Kononov per Chytrý, Pešout et Anenchonov 1993 (App. 3, rel. 6-12)

This community immediately surrounds a wetland behind the shore stone mound near the estuary of the Bol'. Čeremšana. The ecological conditions are similar to that of the above mentioned community, the ground-water level plays, however, a dominant role. The community is characterized by the dominance of the tussocky sedge *Carex juncella*, accompanied by *Calamagrostis langsdorffii* at drier sites. This association is comparatively well-documented in East Siberia, e.g. in alases of Central Yakutia (Mirkin et al. 1985, Gogoleva et al. 1987), Middle Lena Floodplain (Mirkin et al. 1992), Svjatoj Nos peninsula (Chytrý et al. 1993) and the Bol'šoj Čivyrkuj valley (Chytrý et al. 1995). This association belongs to the alliance *Caricion appendiculatae* Achtjamov, Mirkin et Urazmetov 1985.

Carex juncella-Carex rhynchophylla community (App. 3, rel. 13-19)

This species-poor community was found in a shallow lake, at depths from 5 to 50 cm. Similar vegetation with dominant *Carex rhynchophylla* is described from the Bol'šoj Čivyrkuj valley (Chytrý et al. 1995). This community probably belongs to the alliance *Caricion appendiculatae* Achtjamov, Mirkin et Urazmetov 1985.

Eriophorum scheuchzeri community (App. 3, rel. 20-24)

This community was found along a flat of a mountain lake. The habitat is partially flooded in spring. The water level sinks during the summer but the habitat remains wet. The long-lasting snow cover may be another important ecological factor. *Eriophorum scheuchzeri* mires are not documented in phytosociological literature from Siberia (see Korotkov et al. 1991). This community belongs to the alliance *Caricion fuscae* Koch 1926 em. Klika 1934, and is closely related to the association *Eriophoretum scheuchzeri* Rübel 1911 which is distributed in the Alps (Steiner 1993), Scandinavia (Dierssen 1982), Greenland (Holtum 1922), Island (Hadač 1939, 1985) and Svalbard (Hadač 1989). Still, there are conspicuous differences in the species composition between the community under question and analogous mires from Europe and Atlantic region which need further comparative studies with a more extensive relevé material from Siberia.

Hylacomium pyrenaicum-Carex bipartita community (App. 3, rel. 25-32)

This chionophilous community was found along the shore of a mountain lake, occurring on hummocks and on footslopes around the lake. The habitat is moist and sometimes influenced by flowing surface water. However, it is never flooded. The long-lasting snow cover may be an important ecological factor. Besides its species composition, this community differs from the above mentioned one in a high cover of the ground layer consisting of moisture indicating moss species. In some locations, dwarf-shrub willow *Salix rectijulis* is found. No similar communities are known from Siberia (see Korotkov et al. 1991) and classification of this community needs further study.

Shrub and forest communities*Calamagrostis langsdorfii-Salicetum roridae* Chytrý, Anenchonov et Danihelka (App. 4, rel. 1-5)

This is an early successional community on the sandy and gravelly beds of intermittent channels. The main influence, affecting this vegetation type, is the disturbance caused by water flow in spring. No tree layer is usually developed and the shrub layer reaches a low cover. In vegetation zonation, if the disturbing influence of water weakens, this community shifts towards the below mentioned floodplain forests of the *Calamagrostis langsdorfii-Populus suaveolens* community. Similar communities are not reported in Siberian phytosociological literature (see Korotkov et al. 1991).

Aconitum rubicundum-Duschekia fruticosa community (App. 4, rel. 6-9)

This community occurs on rarely flooded, neither disturbed nor wet river banks near the mouth of the Bol'. Čeremšana. No tree layer is developed, the shrub layer is of a high cover. There are no reports on this vegetation type in the available Russian syntaxonomic literature (see Korotkov et al. 1991). *Duschekia fruticosa* dominated shrub communities occur here and there in Siberia, predominantly in the subalpine belt (see Moložnikov 1986: 69). Their syntaxonomy needs further investigations.

Calamagrostis langsdorfii-Populus suaveolens community (App. 4, rel. 10-14)

This floodplain deciduous forest community is typical of the river banks from the estuary of the Bol'. Čeremšana up to ca. 900 m a.s.l. Similar stands were observed at 1350 m a.s.l. *Populus suaveolens* and *Chosenia arbutifolia* forests are widely distributed in the Baikal area (see Moložnikov 1986). This community is also documented from the Nestericha valley in the southern part of the Barguzinskij Range (Chytrý ined.). It

likely belongs to the class *Vaccinio-Piceetea* Br.-Bl. in Br.-Bl., Sissingh et Vlieger 1939, its syntaxonomy, however, has to be subjected to a detailed study.

Calamagrostis obtusata-Abies sibirica community (App. 4, rel. 15-25)

This is a mesophilous community of coniferous forest (dark taiga), occurring on shady north-facing slopes of the valley from the foothills up to approximately 1100 m a.s.l. Communities of this association were also reported from the Bol'šoj Čivyrkuj valley (Chytrý et al. 1995) and similar types of forests are widely distributed throughout the Baikal area (e.g. Tjulina 1976, 1981, Moložnikov 1986).

Maianthemum bifolium-Pinus sibirica community (App. 4, rel. 26-31)

This mesophilous dark taiga community is distributed on gentle slopes and old river and Baikal terraces on the bottom of the valley in its lower part. Soils below this community are well-drained. The habitat is cool because of the climatic influence of Lake Baikal (Tjulina 1967, 1976). This community was described from Svjatoj Nos isthmus (Chytrý and Pešout 1992 under the name *Padus avium-Pinus sibirica* community) and the Bol'šoj Čivyrkuj valley (Chytrý et al. 1995), similar stands are also known from Sosnovka Bay on the North-eastern Baikal shore. Unlike in the Bol'. Čeremšana valley where this vegetation has more or less continuous cover, at all these sites, however, this community forms rather isolated forest patches on consolidated sand dunes. Syntaxonomy of these forests is not yet satisfactorily treated.

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App. 1. (Headings).

Relevé nr.	Area (m ²)	Aspect	Slope (°)	Altitude	Cover E ₂ (%)	Cover E ₁ (%)	Cover E ₀ (%)	Date
1	1	-	0	1 670	0	50	40	30.7.1992
2	4	-	0	1 670	0	60	40	30.7.1992
3	4	-	0	1 670	0	50	40	30.7.1992
4	4	-	0	1 670	0	40	50	30.7.1992
5	12	NNE	3	1 520	30	30	60	30.7.1992
6	4	S	30	1 580	0	50	0	7.8.1992
7	4	W	3	1 520	0	70	40	9.8.1992
8	4	-	0	1 460	0	40	50	30.7.1992
9	2	N	5	1 480	0	30	50	30.7.1992
10	4	N	5	1 510	0	50	50	30.7.1992
11	9	NW	5	1 640	0	70	40	1.8.1992
12	2.5	N	15	1 675	0	60	40	1.8.1992
13	12	S	10	1 480	0	50	20	29.7.1992
14	2.5	SE	20	1 490	0	20	50	29.7.1992
15	16	SW	5	1 430	20	30	30	30.7.1992
16	4	-	0	1 430	0	30	30	30.7.1992
17	16	S	40	1 440	0	20	10	29.7.1992
18	16	SW	35	1 450	0	30	20	29.7.1992
19	9	SSE	20	1 465	0	15	60	29.7.1992
20	4.5	-	0	1 460	0	50	40	30.7.1992
21	16	-	0	1 630	40	10	80	7.8.1992
22	25	-	0	1 630	30	10	90	7.8.1992
23	36	-	0	1 420	40	50	3	30.7.1992
24	25	-	0	1 420	30	60	40	1.8.1992
25	16	-	0	1 450	30	40	30	30.7.1992
26	1.5	W	25	1 710	0	40	50	30.7.1992
27	4	W	20	1 710	0	60	30	30.7.1992
28	4	WNW	30	1 710	0	40	30	30.7.1992
29	1.5	W	25	1 710	0	30	40	30.7.1992
30	1	W	45	1 725	0	30	30	30.7.1992
31	2	S	45	1 600	0	30	5	7.8.1992
32	2	S	50	1 600	0	30	30	7.8.1992

App. 1. (Localities of relevés)

- 1-3. Near the mountain lake in the upper part of the Prjamoj valley.
4. Shores of the mountain lake in the upper part of the Prjamoj valley.
5. Prjamoj valley, 5.1 km NNE of the confluence with the Bol'. Čeremšana river.
6. Slopes on the right side of the valley 10.5 km ENE of the confluence of the Pravaja Bol'. Čeremšana and Levaja Bol'. Čeremšana rivers.

7. Bottom of the valley, 10.7 km ENE of the confluence of the Pravaja Bol'. Čeremšana and Levaja Bol'. Čeremšana rivers.
8. Prjamoj valley, 4.8 km NNE of the confluence with the Bol'. Čeremšana river.
9. Prjamoj valley, 4.7 km NNE of the confluence with the Bol'. Čeremšana river.
10. Prjamoj valley, 5.2 km NNE of the confluence with the Bol'. Čeremšana river.
11. Near the mountain lake in the upper part of the Prjamoj valley.
12. Slopes above the mountain lake in the upper part of the Prjamoj valley.
13. Prjamoj valley, 5.5 km NNE of the confluence with the Bol'. Čeremšana river.
14. Prjamoj valley, 5.2 km NNE of the confluence with the Bol'. Čeremšana river.
15. Prjamoj valley, 4.5 km NNE of the confluence with the Bol'. Čeremšana river.
16. Prjamoj valley, 4.6 km NNE of the confluence with the Bol'. Čeremšana river.
17. Prjamoj valley, 4.8 km NNE of the confluence with the Bol'. Čeremšana river.
18. Prjamoj valley, 4.9 km NNE of the confluence with the Bol'. Čeremšana river.
19. Prjamoj valley, 5.5 km NNE of the confluence with the Bol'. Čeremšana river.
20. Prjamoj valley, 4.8 km NNE of the confluence with the Bol'. Čeremšana river.
- 21-22. Slopes on the right side of the valley 9.8 km ENE of the confluence of the Pravaja Bol'. Čeremšana and Levaja Bol'. Čeremšana Rivers.
23. Prjamoj valley, 4.6 km NNE of the confluence with the Bol'. Čeremšana river.
24. Prjamoj valley, 4.7 km NNE of the confluence with the Bol'. Čeremšana valley.
25. Prjamoj valley, 4.5 km NNE of the confluence with the Bol'. Čeremšana river.
- 26-30. Shores of the mountain lake in the upper part of the Prjamoj valley.
- 31-32. Slopes on the right side of the valley 10.5 km ENE of the confluence of the Pravaja Bol'. Čeremšana and Levaja Bol'. Čeremšana rivers.

App. 2. (Headings).

Relevé nr.	Area (m ²)	Aspect	Slope (°)	Altitude	Cover E ₂ (%)	Cover E ₁ (%)	Cover E ₀ (%)	Date
1	4	SE	15	1 110	0	35	10	26.7.1992
2	4	SE	20	1 110	0	30	0	26.7.1992
3	25	E	2	458	70	20	0	22.7.1992
4	16	E	5	458	30	50	0	22.7.1992
5	16	-	0	458	30	70	0	22.7.1992
6	9	E	5	458	0	40	0	22.7.1992
7	9	E	10	457	0	40	0	22.7.1992
8	16	-	0	458	0	90	0	22.7.1992
9	25	-	0	458	20	80	0	22.7.1992
10	9	-	0	1 070	0	80	20	7.8.1992
11	16	SE	40	1 085	0	90	0	28.7.1992
12	9	SE	45	1 080	0	80	0	28.7.1992
13	4	-	0	1 360	0	70	2	7.8.1992
14	4	S	3	1 360	0	70	20	7.8.1992
15	9	SE	40	1 080	0	95	0	28.7.1992
16	16	W	5	1 675	60	60	2	1.8.1992
17	12	W	5	1 675	50	70	3	1.8.1992
18	12	SW	5	1 620	70	20	30	7.8.1992
19	8	-	0	1 420	50	70	1	30.7.1992
20	20	-	0	1 420	50	80	0	30.7.1992
21	25	-	0	1 410	50	80	0	30.7.1992
22	25	-	0	1 420	60	50	1	30.7.1992
23	25	-	0	1 400	30	70	5	2.8.1992
24	12	W	3	1 650	60	30	40	1.8.1992
25	12	-	0	1 460	60	40	5	30.7.1992
26	25	-	0	1 430	60	30	1	30.7.1992
27	16	-	0	1 400	40	80	10	2.8.1992
28	15	-	0	1 520	40	80	20	9.8.1992
29	9	-	0	1 400	0	95	1	2.8.1992
30	4	W	3	1 665	0	90	30	1.8.1992
31	2	W	5	1 650	0	90	10	1.8.1992
32	9	-	0	1 630	0	80	50	7.8.1992
33	9	-	0	1 520	0	95	70	9.8.1992
34	4	W	5	1 670	0	80	40	1.8.1992
35	6	W	5	1 660	0	40	40	1.8.1992
36	6	W	3	1 660	0	70	30	1.8.1992
37	9	-	0	1 660	0	95	30	1.8.1992
38	9	NW	3	1 660	0	90	40	1.8.1992
39	4	NW	5	1 660	0	70	20	1.8.1992
40	4	NW	10	1 660	0	60	60	1.8.1992
41	4	NW	5	1 660	0	80	60	1.8.1992
42	9	W	3	1 660	0	80	60	1.8.1992

43	9	NW	5	1 635	0	95	20	1.8.1992
44	9	-	0	1 590	0	60	60	7.8.1992
45	9	N	3	1 650	0	90	10	7.8.1992

App. 2. (Localities of relevés)

- 1-2. Bol'. Čeremšana valley, 2.2 km SSE of the mouth.
- 3-9. Bol'. Čeremšana valley, near the mouth.
10. Slopes 3.6 km ENE of the confluence of the Pravaja Bol'. Čeremšana and Levaja Bol'. Čeremšana rivers.
- 11-12. Prjamoj valley, 4 km N of the confluence with Bol'. Čeremšana river.
- 13-14. Bottom of the valley 8.8 km ENE of the confluence of the Pravaja Bol'. Čeremšana and Levaja Bol'. Čeremšana rivers.
15. Prjamoj valley, 4 km N of the confluence with the Bol'. Čeremšana river.
- 16-17. Slopes above the mountain lake in the upper part of the Prjamoj valley.
18. Slopes on the right side of the valley 9.8 km ENE of the confluence of the Pravaja Bol'. Čeremšana and Levaja Bol'. Čeremšana rivers.
- 19-20. Prjamoj valley, 4.6 km NNE of the confluence with the Bol'. Čeremšana river.
21. Prjamoj valley, 4.7 km NNE of the confluence with the Bol'. Čeremšana river.
22. Prjamoj valley, 4.6 km NNE of the confluence with the Bol'. Čeremšana river.
23. Prjamoj valley, 4.7 km NNE of the confluence with the Bol'. Čeremšana river.
24. Near the mountain lake in the upper part of the Prjamoj valley.
25. Prjamoj valley, 4.8 km NNE of the confluence with the Bol'. Čeremšana river.
26. Prjamoj valley, 4.5 km NNE of the confluence with the Bol'. Čeremšana river.
27. Prjamoj valley, 4.7 km NNE of the confluence with the Bol'. Čeremšana river.
28. Bottom of the valley, 10.7 km ENE of the confluence of the Pravaja Bol'. Čeremšana and Levaja Bol'. Čeremšana rivers.
29. Prjamoj valley, 4.7 km NNE of the confluence with the Bol'. Čeremšana river.
- 30-31. Near the mountain lake in the upper part of the Prjamoj valley.
32. Valley of the Čeremšanye Lakes, 10.1 km of ENE the confluence of the Pravaja Bol'. Čeremšana and Levaja Bol'. Čeremšana rivers.

11. Bol'. Čeremšana valley, alluvial forest on the left river bank 0.5 km ESE of its mouth.
12. Bol'. Čeremšana valley, alluvial forest on the left river bank 1 km ESE of the mouth.
13. Bol'. Čeremšana valley, near the mouth.
14. Near the confluence of the Pravaja Bol'. Čeremšana and Levaja Bol'. Čeremšana rivers.
15. Bol'. Čeremšana valley, taiga forest 0.8 km S of its mouth.
16. Bol'. Čeremšana valley, 0.8 km SSE of the mouth.
17. Bol'. Čeremšana valley, 1.1 km SSE of the mouth.
18. Bol'. Čeremšana valley, 1.4 km SSE of the mouth.
19. Bol'. Čeremšana valley, 1.6 km SSE of the mouth.
20. Bol'. Čeremšana valley, 1.8 km SSE of the mouth.
21. Bol'. Čeremšana valley, 2.0 km SSE of the mouth.
22. Bol'. Čeremšana valley, 2.2 km SSE of the mouth.
23. Bol'. Čeremšana valley, 2.3 km SSE of the mouth.
24. Prjamoj valley, 3.4 km NNE of the confluence with the Bol'. Čeremšana river.
25. Near the confluence of the Bol'. Čeremšana river and the Gordelan creek.
26. Bol'. Čeremšana valley, taiga forest 0.5 km S of its mouth.
27. Bol'. Čeremšana valley, taiga forest 0.6 km SE of its mouth.
28. Bol'. Čeremšana valley, taiga forest 0.7 km S of its mouth.
29. Bol'. Čeremšana valley, taiga forest 0.8 km SSE of its mouth.
30. Bol'. Čeremšana valley, taiga forest 1 km SE of its mouth.
31. Bol'. Čeremšana valley, taiga forest on the right river bank 1.5 km ESE of the mouth