Botanica Pacifica. A journal of plant science and conservation. 2024.
DOI: 10.17581/bp.2023.13111

VEGETATION CLASSIFICATION

Syntaxonomy of the Numto Nature Park vegetation (northern taiga, Western Siberia): 2. The class Scheuchzerio–Caricetea nigrae Tx. 1937

Elena D. Lapshina[1], Il'ya V. Filippov[1], Galina N. Ganasevich[1], Elena L. Verevkina[2]

Elena D. Lapshina [1] *
e-mail: e_lapshina@ugrasu.ru

Il'ya V. Filippov [1]
e-mail: filip83pov@yandex.ru

Galina N. Ganasevich [1]
e-mail: ganasevich@yandex.ru

Elena L. Verevkina [2]
e-mail: numtonauka@mail.ru

[1] Yugra State University, Khanty-Mansiysk, Russia

[2] Numto Nature Park, Beloyarskiy, Russia

* corresponding authors

Manuscript received: 05.10.2023
Review completed: 04.02.2024
Accepted for publication: 14.03.2024
Published online: 19.03.2024

ABSTRACT

The syntaxonomic diversity of vegetation belonging to the class Scheuchzerio-Caricetea nigrae Tx. 1937 was revealed in the Numto Nature Park located in the northern taiga subzone of Western Siberia (63°7'–64°20'N 69°44'–71°45'E, Khanty-Mansi Autonomous Area). Based on 420 geobotanical relevés, a phytocoenotic characteristic is provided for 15 associations, 16 subassociations (5 associations and 6 subassociations being described as new), 14 variants, and 1 community type, which are assigned to four alliances belonging to three orders. Furthermore, one association and one subassociation, previously described within the Uppsala School framework have been validated with the rank change. Ordination of the identified syntaxa using t-SNE analysis, supplemented with cluster analysis, was conducted to assess the degree of similarity between individual syntaxa.

Keywords: mire vegetation, Braun-Blanquet classification, class Scheuchzerio–Caricetea nigrae, northern taiga, Khanty-Mansiysk Autonomous Area – Yugra, Beloyarsk District, Western Siberia

РЕЗЮМЕ

Лапшина Е.Д., Филиппов И.В., Ганасевич Г.Н., Веревкина Е.Л. Синтаксономия растительности природного парка Нумто (северная тайга, Западная Сибирь): 2 – класс Scheuchzerio–Caricetea nigrae Tx. 1937. Установлено синтаксономическое разнообразие растительности класса Scheuchzerio–Caricetea nigrae Tx. 1937 природного парка "Нумто", расположенного в подзоне северной тайги Западной Сибири (63°7'–64°20'N 69°44'–71°45'E, Ханты-Мансийский автономный округ). На основе 420 геоботанических описаний дана фитоценотическая характеристика 15 ассоциаций, 16 субассоциаций, 14 вариантов и 1 типа сообществ, которые отнесены к 4 союзам из 3 порядков. При этом 5 ассоциаций и 6 субассоциаций описаны как новые. Валидизированы 1 ассоциация и 1 субасоциация (с изменением ранга), описанных ранее в рамках Уппсальской школы. Проведена ординация выделенных синтаксонов методом t-SNE, дополненная кластерным анализом, для оценки степени сходства между отдельными синтаксонами.

Ключевые слова: растительность болот, классификация Браун-Бланке, класс Scheuchzerio–Caricetea nigrae, северная тайга, Ханты-Мансийский автономный округ – Югра, Белоярский район, Западная Сибирь

The paper continues the series of publications on the vegetation of the Numto Nature Park, the territory representative of the entire northern taiga subzone in the central part of Western Siberia. It aims at examining the syntaxonomic structure of the largest class of mire vegetation, Scheuchzerio-Caricetea nigrae Tx. 1937, and characterizing its communities and distribution features.

The class Scheuchzerio-Caricetea nigrae includes sedge-moss vegetation of minerotrophic fens, transitional mires and ombrotrophic bog hollows in the Northern Hemisphere. A recent statistical analysis conducted by Peterka et al. (2017) on a large dataset of primary data (approximately 30,000 relevés) accumulated in Europe has confirmed that the species composition of communities within this class and their ecological and cenotic position are primarily determined by the acidity gradient (pH) and mineral nutrient richness. Geographic/macroclimatic variation was reflected in the second most important gradient. DCA ordination of plant communities conducted along these axes has confirmed the existence of 13 alliances in Europe, of which three are endemic to the Atlantic coast of Western Europe and the Balkan Peninsula, while two are associated with carbonate outcrops and occur sporadically in the foothill of mountains in Europe and the Polar Urals (Lapshina et al. 2021). The remaining eight alliances have a broader distribution in the temperate, boreal, and arctic zones of Northern Eurasia.

Previously, we conducted a classification of communities belonging to two alliances (Stygio-Caricion limosae Nordhagen 1943 and Scheuchzerion palustris Nordhagen ex Tx. 1937) within the class Scheuchzerio-Caricetea nigrae in the northern part of Western Siberia, in the latitudinal range from the northern taiga to the southern tundra (Lapshina et al. 2022). The present publication complements the previously identified syntaxa with new relevés made within the Numto Nature Park in the southern part of the northern taiga. It also provides the description of both widely distributed and rare communities of other alliances within this class.

The territory of Numto Nature Park can serve as a site for a detailed vegetation study to allow of a comprehensive understanding of the species and phytocenotic diversity of mire vegetation belonging to the class Scheuchzerio-Caricetea nigrae in the subzone of the northern taiga in Western Siberia, located on the southern boundary of permafrost distribution.

MATERIAL AND METHODS

The natural conditions of the nature park were characterised in a previous publication focusing on the classification of vegetation in forests, swampy forests, and wooded swamps (Lapshina et al. 2024).

Due to the lithologic peculiarities, flat relief, and postglacial history of the region, the nature park, like the entire subzone of the northern taiga, is heavily bogged (Romanova 1977). Peatlands cover 63 % of the park's territory (Valeeva et al. 2008, Moskovchenko et al. 2017).

The peatlands are located in the sources and valleys of large and small rivers, streams and brooks, on river terraces, slopes and plateaus of flat watershed areas. Mire communities of the class Scheuchzerio–Caricetea nigrae are found in all types of peatlands, where they develop in moderately wetted and waterlogged hollows, floating Sphagnum lawns, quaking mats and fens with a high groundwater level.

The syntaxonomic analysis and classification were based on the 420 geobotanical relevés of the sedge-moss mires conducted in 2006, 2017, and 2022 within the territory of the Numto Nature Park.

Methods of sampling and data analysis as well as the vegetation classification approach followed the principles of the Braun-Blanquet school (Westhoff & Maarel 1978) were decried earlier (Lapshina et al. 2024).

New syntaxa were described in accordance with the requirements of the International Code of Phytosociological Nomenclature (Theurillat et al. 2021). In the names of associations, the taxon name from the highest dominant layer (ICPN, Art. 10b) or, in cases of low projective cover of vascular plants (25 % or less), the name of the moss edificator species determining the structure of the mire communities, was placed in the second position. The nomenclature of higher syntaxa follows Mucina et al. (2016). Nomenclature of the species followed Sekretareva (2004) for vascular plants, Trichophorum spp.: Panarctic Flora (Online), Ignatov et al. (2006) for mosses, Konstantinova et al. (2009) for liverworts.

RESULTS

The class Scheuchzerio palustris–Caricetea nigrae comprises floristically rich communities of open and sparsely wooded sedge-moss minerotrophic fens, as well as relatively species-poor communities of mesotrophic transitional mires, and oligotrophic sedge-*Sphagnum* hollows and floating mats of raised bog system in the Holarctic region.

Diagnostic species of the class: *Carex lasiocarpa*, *C. rostrata*, *C. limosa*, *C. chordorrhiza*, *Andromeda polifolia*, *Oxycoccus palustris*, *Comarum palustre*, *Menyanthes trifoliata*, *Eriophorum angustifolium, E. gracile*..

In the Braun-Blanquet floristic classification, the class Scheuchzerio–Caricetea nigrae within the territory of the Numto Nature Park is represented by four alliances belonging to three orders Sphagno warnstorfii–Tomentypnetalia Lapshina 2010, Caricetalia nigrae Koch 1926, and Scheuchzerietalia palustris Nordhagen 1936 ex Tx. 1937.

Sedge-moss moderately rich fen vegetation

We place the sedge-moss vegetation of moderately rich minerotrophic fens into the order Sphagno warnstorfii–Tomentypnetalia Lapshina 2010 and the alliance Sphagno warnstorfii–Tomentypnion nitentis Dahl 1957.

Order **Sphagno warnstorfii–Tomentypnetalia**

The order comprises sedge-brown moss and shrub-herb-moss (hypno-sphagnous) communities of minerotrophic fens with mineral rich ground water supply.

Daignostic species of the order: *Aulacomnium palustre*, *Bryum pseudotriquetrum*, *Campylium stellatum*, *Calamagrostis neglecta*, *Carex diandra*, *C. dioica*, *Drepanocladus aduncus*, *Hamatocaulis vernicosus*, *Helodium blandowii*, *Tomentypnum nitens*.

The alliance **Sphagno warnstorfii–Tomentypnion nitentis** combines sedge-moss and shrub (*Betula nana*)-sedge-*Sphagnum* communities of flat hummocks and carpets, dominated by *Sphagnum warnstorfii* in the moss layer, in minerotrophic fens with moderately mineral-rich ground water supply.

Diagnostic species of the alliance: *Calamagrostis neglecta*, *Carex magellanica* subsp. *irrigua*, *Sphagnum warnstorfii* and the order species *Aulacomnium palustre*, *Helodium blandowii*, *Tomentypnum nitens*.

Alliance **Sphagno–Caricion canescentis** Passarge (1964) 1978

Meso-oligotrophic and oligotrophic species of this alliance – *Sphagnum obtusum*, *Straminergin stramineum,* and the class Oxycocco–Sphagnetea Br.-Bl. & Tx. ex Westhoff & al. 1946 – *Chamaedaphne calyculata*, *Drosera rotundifolia*, *Sphagnum angustifolium* are differentiating species with regard to the alliance Saxifrago–Tomentypnion Lapshina 2010.

We include two associations previously described to this alliance in the Numto Nature Park.

Sphagno teretis–Betuletum nanae Lapshina et al. 2018 (Table 1, rel. 3–37; Table 8, syntaxon 1, 2; Figs 1A, 2, clusters 1.1, 1.2)

The association comprises open mesotrophic sedge-moss and sedge-*Menyanthes*-moss fens and shrubby (*Betula nana*)-sedge-moss communities evolving in small rivers and brook valleys (Fig. 1A). This association with three variants (typicum, Sphagnum centrale, and S. warnstorfii), was first described on minerotrophic peatlands in the Em-Egan River valley (left tributary of the Malaya Sos'va River) within the "Malaya Sos'va" Nature Reserve, located in the subzone of the middle taiga of Western Siberia (Lapshina et al. 2018).

Diagnostic species: *Betula nana*, *Carex magellanica* subsp. *irrigua*, *Cephalozia plenicaps*, *Scapania paludicola*, *Sphagnum angustifolium*, *S. fimbriatum*, *S. obtusum*, *S. riparium*, *S. russowii*, *S. squarrosum*, *S. subsecundum*, *S. teres*.

Structure and composition: The association is characterized by a high species diversity (ranging from 20 to 32 species in a single relevé, rarely fewer). Despite the relatively low constancy in species composition, community association are easily recognizable in the field due to the combination of diagnostic species. In communities a more or less dense shrub layer is formed by the dwarf birch (*Betula nana*), 30–40 cm high, or it may be absent. The herb-dwarf shrub layer is mainly composed of *Carex magellanica* subsp. *irrigua* and *Menyanthes trifoliata*, the abundance of which varies from a small percentage to 40–60 % in different communi-

ties. Dwarf shrub species with a high degree of constancy include *Andromeda polifolia* and *Oxycoccus palustris*, and among herbaceous plants, sedges like *Carex limosa*, *C. chordorrhiza*, *C. rostrata*, as well as *Eriophorum angustifolium* and *Equisetum fluviatile*, show strong persistence. In the moss layer, up to 30 species of mosses and liverworts are combined in various proportions. Among them, *Aulacomnium palustre*, *Helodium blandowii*, *Sphagnum riparium*, *S. squarrosum*, *S. teres*, *S. fimbriatum*, *S. centrale*, *S. russowii*, *S. obtusum*, and *Scapania paludicola* stand out with the highest degree of constancy.

Distribution and ecology. The communities of this association develop in mesotrophic mires with moderately rich soil nutrients in the valleys of small rivers and brooks within the subzones of middle and northern taiga in Western Siberia.

Based on the dominant moss species, two subassociations within the association have been distinguished.

Subassociation **Sphagno teretis–Betuletum nanae typicum** (Table 1, rel. 1–17; Table 8, syntaxon 1; Figs 1A, 2, cluster 1.1)

The subassociation represents the nomenclatural type of the association (autonym), when the latter is subdivided into subordinate units of lower rank [ICPN, Art. 13b] (Theurillat et al. 2021).

Holotypus: Table 2 releve 16 (author's number 72-16) in Lapshina et al. 2018: 89 – autonyms [Art. 5b, 13b].

Diagnostic species: Same as in the association.

Structure and composition. These communities are characterized by a well-developed shrub layer dominated by dwarf birch (*Betula nana*), with a projected cover ranging from 3–5 % to 60–80 % (Fig. 1A). In the grass layer, in addition to the diagnostic species of the association with high constancy and abundance there occur *Comarum palustre* and *Menyanthes trifoliata*, and *Sphagnum angustifolium* in the moss layer.

Distribution and ecology. Within the nature park, subassociation communities develop in moderately wet areas of mesotrophic fens. They are typically found on the periphery of small river valley peatlands or adjacent to the zone of wet dark coniferous forests and wooded spruce-pine swamps (locally called "sogra"), spread along the banks of brooks and rivers.

Subassociation **Sphagno teretis–Betuletum nanae sphagnetosum warnstorfii subass. nov.** (Table 1, rel. 18–28; Table 8, syntaxon 2; Fig. 2, cluster 1.2)

Previously, within the association, a variant *Sphagnum warnstorfii* was identified (Lapshina et al. 2018: rel. 1–5 in Table 2), and we have ranked it as a subassociation.

Holotypus: relevé 23 (author's number 003E22nu) in Table1: KhMAO, Beloyarsk District, Numto Nature Park, 12.08.2022, author E. Lapshina.

Diagnostic species: *Sphagnum angustifolium*, *S. warnstorfii*, and diagnostic species of the association.

Structure and composition: The 40–50 cm high shrub layer is formed by *Betula nana* with the coverage ranging from 5 to 60 %. Among the dwarf shrubs, *Andromeda polifolia* is noticeable in significant abundance (up to 25 %). In the grass layer, about 20–25 cm high, *Menyanthes trifoliata* dominates (up to 60 %), accompanied by *Comarum palustre* (up to 5 %). *Carex limosa*, *C. magellanica* subsp. *irrigua*, *C. dioica*, *C. diandra*, and *Calamagrostis neglecta* are present with less abundance and constancy. The surface of the continuous *Sphagnum* mat is covered by *Oxycoccus palustris*. These communities differ due to the significant presence of *Sphagnum warnstorfii* (10–30 %) in the moss layer, alongside with *Aulacomnium palustre*, *Helodium blandowii*, *Sphagnum angustifolium*, *S. squarrosum*, and *S. teres*.

Distribution and ecology. Rare communities. Within the nature park, these are found in peatlands associated with locations where groundwater discharges at the sources of streams. Habitats have a hummocky nanorelief surface with narrow, deep micro-depressions holding water. The relative elevation difference ranges from 15 to 25 cm. Occasionally, stunted (1–3 to 5 m tall) birch and pine trees, and less frequently *Pinus sibirica*, occupy the hummocks.

Association **Sphagno warnstorfii–Caricetum dioicae** Lapshina 2010.

The association was first described in minerotrophic mire complexes in the southern forest zone of Western Siberia (Lapshina 2010).

Diagnostic species: *Carex dioica*, *C. chordorrhiza*, *Sphagnum warnstorfii* (dom.).

Structure and composition. The communities typically have a well-defined herb-dwarf shrub layer, mainly composed of *Andromeda polifolia* 10–15 cm high, occasionally it is absent. Among herbaceous plants, *Comarum palustre*, *Menyanthes trifoliata*, and *Equisetum fluviatile* are consistently present. Low-growing sedges such as *Carex dioica*, occasionally *C. chordorrhiza*, have limited coverage. Flat hammocks *Sphagnum warnstrofii* forms the base of the communities, occasionally accompanied by brown mosses like *Tomentypnum nitens* and *Aulacomnium palustre*. On the moss surface, *Drosera rotundifolia* and *Oxycoccus palustris* can be found.

Distribution and ecology. The small-sedge-*Sphagnum* and small-sedge-moss communities dominated by *Sphagnum warnstorfii* are characteristic of the mire vegetation complexes in the minerotrophic peatlands of Western Siberia. In the south of the forest zone, this association is characterized by the optimal development and dominance of *Carex dioica* in the low-growing herbaceous layer, typically more or less accompanied by *C. chordorrhiza* (Lapshina 2010).

Under lower mineral nutrition in the northern taiga subzone, there is no *Carex dioica* in the association communities. The fact allows to identify a distinct northern-taiga variant *Carex chordorrhiza* within the association.

Variant **Carex chordorrhiza** (Table 1, rel. 29–35; Table 8, syntaxon 3; Figs 1B, 2, cluster 2)

Structure and composition. The communities of this variant are characterized by a relatively dense (5–20 %) dwarf shrub layer composed of *Andromeda polifolia*, ranging from 5 to 10 cm in height, occasionally they are absent. Of the shrubs, *Betula nana* is usually present. *Oxycoccus palustris* grows on the moss carpet. The grass layer is dominated by *Menyanthes trifoliata* (5–25 %), accompanied by *Carex chordorrhiza*, *C. limosa*, *C. magellanica* subsp. *irrigua*, *Comarum palustre*, *Drosera rotundifolia*, *Equisetum fluviatile*. The moss layer is entirely dominated by *Sphagnum warnstorfii*, and its dense carpet forms large flat hummocks ranging from 1 to 3 m in diameter. A slight addition (up to 10 %) includes *Aulacomnium palustre*, *Helodium blandowii*, *Sphagnum angustifolium*, and rarely *S. obtusum*.

Distribution and ecology. Such communities are extremely rare in the nature park. They form large flat sedge-moss 20–25(30) cm high hummocks or "clumps" with a rounded shape, developing among shrub (*Betula nana*)-sedge-moss communities at places where groundwater emerges. The groundwater level is at a depth of 20–25 cm.

Note: A similar name association, Sphagno–Caricetum dioicae Gillet, 1982 was used in Central Europe to describe mire vegetation in the Jura Mountains. As *Sphagnum teres* is the dominant species indicated in the protologue of the association, there is no reason to change the name Sphagno warnstorfii–Caricetum dioicae Lapshina 2010 according to Art. 31 of ICPN (Theurillat et al. 2021).

Sedge-peat moss poore fens vegetation

We assign the sedge-*Sphagnum* and sedge-moss-hepatic communities of poor minerotrophic fens identified within the nature park to the order Caricetalia nigrae Koch 1926 and its 2 alliances: Sphagno–Caricion canescentis Passarge 1978 and Stygio–Caricion limosae Nordhagen 1943.

The order Caricetalia nigrae encompasses sedge-moss communities on peat and peat-mineral saturated soils with a wide range of water-mineral nutrition, from moderately enriched to poor in mineral elements, and from slightly acidic to acidic substrate reaction. Occupying a central position within the class Scheuchzerio–Caricetea nigrae, this order, in its contemporary understanding, is poorly differentiated and has practically no distinctive diagnostic species.

Table 1. Associations of the alliance Sphagno warnstorfii–Tomentypnion nitentis. Dwarf birch-sedge-moss communities of minerotrophic fens in small river and steam valleys. 1–35 – Sphagno teretis–Betuletum nanae (1): 1–17 – subass. typicum (1a), 18–28 – subass. sphagnetosum warnstorfianii (1b); 29–35 – Sphagno warnstorfii–Caricetum dioicae var. Carex chordorrhiza (2). Abbreviations: (a) – tree layer, (a3) – undergrowth of trees.

Association	**Sphagno teretis–Betuletum nanae (1)**																																					**(2)**							**Constancy and abundance**			
Subassociation	**typicum (1a)**																		**sphagnetosum warnstorfii (1b)**																		**–**											
Average tree hight, m	-	-	-	4	3	-	-	-	3	-	-	-	-	-	-	-	3	3	2	-	3	3	2	1	1	5	1	-	2	3	-	-	-	-	-	-	-										
Plant cover, %																																																
trees	0	0	0	2	3	0	0	0	3	0	0	0	0	0	0	0	3	3	5	0	5	2	3	<1	7	10	10	0	5	3	0	0	0	0	0	0	0										
shrubs																																					0										
dwarf shrubs / herbs	10	15	40	20	35	60	0	60	45	65	85	40	30	60	15	40	40	60	20	35	50	30	60	30	30	15	5	35	60	15	15	3	3	15	30										
mosses	90	95	100	100	85	100	100	100	90	95	75	95	85	100	100	95	100	90	100	95	100	100	95	100	90	60	90	90	100	100	80	100	100	100	100										
Number of species	15	21	25	22	22	27	20	23	22	23	17	20	24	21	14	29	29	27	22	27	25	28	28	32	34	27	23	23	24	14	16	12	11	17	11										
Relevé nr. by author	346E17nu	042F17nu	400E17nu	376E17nu	060F17nu	404E17nu	424a17nu	423E17nu	088F17nu	008E22nu	083F17nu	092E22nu	006F22nu	056V22nu	075G22nu	103F17nu	006G22nu	431E17nu	081E22nu	104F17nu	003G22nu	004E22nu	003E22nu	065G22nu	061F22nu	022F22nu	027E22nu	010V22nu	024G22nu	023F22nu	012V22nu	028E22nu	029E22nu	030E22nu	011V22nu											
Relevé nr. in the table	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23***	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**1a**	**1b**	**1**	**2**
Species of tree layer																																							
Betula pubescens (a)	·	·	·	1	1	·	·	·	1	·	·	·	·	·	·	+	+	+	·	+	1	·	·	·	1	·	·	1	1	·	·	·	·	·	·	II	III	II	I
Pinus sylvestris (a)	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	+	r	·	·	+	·	·	·	1	·	·	·	·	·	·	·	·	·	·	I	II	I	·
Pinus sibirica (a)	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1	+	+	·	1	·	·	·	·	1	·	·	·	·	·	·	·	·	·	·	I	II	I	·
Picea obovata (a)	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	1	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	I	I	I	·
Betula pubescens (a3)	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	1	+	+	1	·	2a	·	·	+	·	·	·	·	·	·	I	III	I	I
Pinus sylvestris (a3)	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	+	+	1	·	·	·	·	+	·	·	·	·	·	·	I	II	I	I
Pinus sibirica (a3)	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	+	·	1	·	·	·	·	·	·	·	·	·	·	·	I	I	I	·
Diagnostic species of the ass. Sphagno teretis–Beuletum nanae subass. typicum																																							
Betula nana	1	2a	1	1	3	3	1	4	1	3	5	3	2b	3	2b	3	2b	4	2b	3	3	2b	4	2b	3	+	1	1	3	1	1	·	·	+	·	V^{2b}	V^{2b}	V^{2b}	III^{+}
Sphagnum angustifolium	1	1	3	3	2a	3	2b	2b	2a	4	2a	2b	2b	4	4	2b	3	3	4	2b	1	2b	2b	2b	4	·	·	·	2b	2a	1	2a	·	1	·	V^{2b}	IV^{2b}	IV^{2b}	IV^{1}
Carex magellanica subsp. *irrigua*	4	·	1	1	r	+	3	+	·	+	·	+	+	+	·	r	1	+	+	+	1	+	+	2a	+	+	·	+	1	+	+	+	·	1	·	IV^{+}	V^{+}	V^{+}	IV^{+}
Scapania paludicola	·	1	1	1	+	1	2b	1	r	+	·	+	2a	+	·	1	2a	r	+	+	·	+	+	+	+	+	2a	·	·	·	+	·	·	r	·	V^{1}	V^{+}	IV^{+}	II
Sphagnum riparium **S.-C.c.**	2b	2a	1	2b	·	1	1	·	·	·	·	1	·	1	2b	·	·	+	·	+	·	·	·	+	·	·	1	1	·	·	·	·	·	·	·	III^{1}	III	IV^{+}	·
Sphagnum squarrosum	3	+	1	1	+	1	2b	1	1	·	+	·	+	·	·	1	·	·	·	·	·	1	+	+	2b	+	1	2b	2b	·	·	·	·	·	·	IV^{+}	IV^{+}	IV^{+}	·
Sphagnum obtusum ***S.-C.c.***	·	2b	·	2a	·	·	·	·	2b	2a	·	2a	2a	2b	·	·	·	·	·	·	·	·	2b	1	·	·	1	2a	1	·	·	1	·	+	1	+	III	III	III	III^{+}
Sphagnum teres	·	·	3	·	·	3	2a	2a	·	·	1	3	·	2b	·	·	·	2a	·	1	3	3	2a	·	·	·	·	·	·	·	·	·	·	·	·	III	III	III	·
Sphagnum fimbriatum	2b	+	·	1	·	1	2b	2b	·	1	3	·	1	·	·	·	1	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	III^{1}	I	II	·
Sphagnum centrale	·	·	1	·	·	r	·	2a	3	2b	·	·	2a	·	·	3	1	3	·	3	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	III	II	II	·
Sphagnum russowii	1	3	1	1	4	·	·	·	·	·	·	·	·	·	·	2b	·	·	·	1	·	·	·	2b	·	·	·	·	·	·	·	·	·	·	·	II	I	II	·
Sphagnum subsecundum	·	r	·	·	·	·	·	r	·	·	·	·	·	·	·	+	·	·	·	·	1	+	+	+	+	·	·	·	·	·	·	·	·	·	·	I	III	II	·
Schljakovia kunzeana	·	·	+	·	+	r	·	·	·	+	·	+	+	+	·	r	·	·	+	·	·	·	+	+	+	·	·	+	·	·	·	·	·	·	·	III	III	III	·
Cephalozia pleniceps	·	·	·	·	r	r	·	·	·	·	·	+	·	r	·	·	+	·	+	·	·	+	+	+	+	·	+	·	+	·	·	·	·	+	·	II	III^{+}	II	II
Diagnostic species of the S. t.–B. n. subass. sphagnetosum warnstorfii and ass. Sphagno warnstorfii–Caricetum dioicae																																							
Sphagnum warnstorfii **S.w.-T.n.**	1	·	·	·	·	·	1	2a	·	·	·	·	·	·	·	1	·	2b	2b	3	3	3	3	3	2b	2a	2b	3	**4**	**5**	**4**	**5**	**5**	**5**	**5**	II	V^{3}	III	V^{5}
Drosera rotundifolia	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	1	·	+	·	·	·	·	+	+	+	+	1	1	+	+	1	+	+	+	I	III^{+}	**II**	V^{+}
Carex diandra	·	·	r	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1	2a	1	·	·	·	·	+	·	+	I	II	**I**	II
Diagnostic species of the Sphagno warnstorfii–Tomentypnion nitentis																																							
Aulacomnium palustre	·	+	2a	2a	1	+	1	2a	1	2a	+	+	2a	1	2a	2a	1	2a	2b	1	1	+	2b	2b	+	1	2b	2a	1	+	1	1	+	+	+	V^{1}	V^{2a}	V^{1}	V^{+}
Straminergon stramineum	·	1	1	2a	+	r	+	1	·	+	·	1	1	+	1	+	+	1	1	r	1	+	1	2a	+	+	+	+	+	+	·	·	+	·	·	V^{+}	V^{+}	V^{+}	III^{+}
Helodium blandowii	·	1	2b	2b	1	1	+	·	1	·	r	2a	1	+	·	·	·	1	+	+	1	+	2a	1	2a	3	2a	2a	1	·	·	+	+	·	+	IV^{+}	V^{1}	IV^{1}	III^{+}
Calamagrostis neglecta	·	·	+	+	+	·	1	·	·	·	·	·	·	·	·	·	·	r	+	+	1	·	+	+	+	·	·	1	·	·	·	·	·	·	·	II	IV^{+}	III	·
Carex dioica	·	·	+	·	·	+	·	+	·	·	·	·	·	·	·	r	·	r	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	II	I	I	·
Paludella squarrosa	·	·	·	·	·	·	·	·	·	·	·	+	·	1	·	·	·	·	·	·	·	·	·	+	+	+	·	·	·	·	·	·	·	·	·	I	II	I	·
Diagnostic species of the Scheuchzerio–Caricetea nigrae																																							
Menyanthes trifoliata	·	2b	3	3	2b	4	3	2a	·	3	r	1	1	·	2a	2b	2b	3	3	3	2b	2b	4	2b	2a	2b	2b	2b	2b	2b	2b	1	2a	2b	2a	V^{2b}	V^{2b}	V^{2b}	V^{2b}
Oxycoccus palustris	1	1	2b	·	2a	2a	1	2b	1	2a	·	1	1	2a	1	1	1	2a	1	+	1	1	2b	1	1	1	2b	2a	1	2b	1	4	3	1	2b	V^{1}	V^{1}	V^{1}	V^{2b}
Andromeda polifolia	1	1	3	2b	1	2a	+	r	2b	2b	2a	2a	2b	2a	2a	+	2b	+	1	1	2b	2b	1	2a	+	2b	1	2a	2b	2a	2b	1	·	2b	·	V^{2a}	V^{1}	V^{2a}	IV^{2a}
Comarum palustre	2b	+	1	+	1	+	2a	1	2a	1	+	2a	+	2a	1	1	1	1	2a	+	1	+	1	1	+	+	·	1	1	2b	·	+	·	·	·	V^{1}	V^{1}	V^{1}	III
Carex limosa	+	1	·	1	+	+	2a	·	1	·	·	+	+	1	1	·	+	·	·	·	+	·	1	·	2b	2b	1	+	1	+	1	1	+	1	+	IV^{+}	III^{+}	IV^{+}	V^{1}
Carex chordorrhiza	·	1	1	1	1	+	·	·	·	+	+	·	+	·	2b	+	1	+	+	·	1	+	+	1	·	1	+	+	1	1	1	·	+	1	+	IV^{+}	V^{+}	IV^{+}	V^{1}
Equisetum fluviatile	·	·	+	·	+	+	·	·	+	·	·	·	·	·	1	+	·	+	1	+	1	1	1	1	1	1	1	+	1	1	1	+	+	+	+	II	V^{1}	IV^{+}	V^{+}
Carex rostrata	·	·	+	+	·	1	·	1	r	1	·	1	1	1	1	+	1	1	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	IV^{+}	I	III^{r}	·
Eriophorum angustifolium	r	·	·	1	+	·	+	+	+	+	·	·	+	·	1	+	1	·	·	1	·	·	·	·	+	·	·	·	+	r	·	·	·	·	·	IV^{+}	I	III^{r}	II
Warnstorfia exannulata	1	2a	·	·	·	·	2b	·	·	·	·	·	·	·	·	1	·	·	+	1	1	·	·	·	1	+	·	+	+	·	·	·	·	·	·	II	III^{+}	II	I
Warnstorfia fluitans	·	·	·	·	·	·	·	r	·	+	·	·	1	1	·	·	1	·	·	·	·	·	1	1	·	·	1	·	·	·	·	·	·	·	·	II	II	II	·
Other species																																							
Pohlia nutans	·	r	·	·	+	·	·	·	·	·	·	·	r	·	·	·	+	·	+	·	+	·	r	+	+	·	·	·	·	·	·	·	·	·	·	II	III	III	·
Hammarbya paludosa	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	+	·	·	·	+	+	·	·	·	·	·	·	·	·	·	·	·	II	I	·
Eriophorum gracile	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	1	·	·	·	·	·	·	·	·	·	I	I	·
Calliergon cordifolium	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	1	·	+	·	·	+	+	·	·	·	·	·	·	·	·	·	I	II	I	·
Sphagnum aongstroemii	·	·	·	·	·	·	·	+	+	·	2a	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	I	·	I	·
Scapania paludosa	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	+	·	·	1	·	·	·	·	·	·	·	·	·	·	·	·	·	·	I	I	I	·
Chamaedaphne calyculata	·	·	·	·	·	·	·	·	2b	1	2a	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	I	·	I	·
Epilobium palustre	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	I	I	I	·
Scheuchzeria palustris	·	·	·	·	·	·	·	·	·	·	·	·	1	·	·	·	1	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	I	·	I	·
Sphagnum jensenii	·	·	·	·	·	·	·	·	·	·	1	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	I	·	I	·
Sphagnum lindbergii	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	I	·	I	·
Calypogeia sphagnicola	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	r	·	·	I	II
Rhizomnium pseudopunctatum	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1	+	·	·	+	·	1	·	·	·	·	·	·	·	II	I	I
Sphagnum mirum	1	·	·	·	·	·	·	·	·	·	·	2b	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	I	·	I	·
Dactylorhiza hebridensis	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	r	·	·	+	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	I	I	I	·
Calamagrostis purpurea	·	·	+	·	·	·	·	·	·	·	1	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	**I**	**I**	**I**	·
Carex pauciflora	·	·	·	·	·	+	·	·	·	+	·	·	·	·	·	r	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	**I**	·	**I**	·

Table 1. Continued.

Relevé nr. in the table	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23*	24	25	26	27	28	29	30	31	32	33	34	35	1a	1b	1	2
Polytrichum strictum	·	·	·	r	·	·	·	·	·	·	r	·	·	·	·	·	·	r	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	**I**	**I**	**I**	·
Pseudobryum cinclidioides	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1	·	·	·	·	1	·	·	·	+	·	·	·	·	·	·	·	·	·	·	**I**	**I**	**I**	·

Note. Species found in 1–2 relevés: *Brachythecium mildeanum* (27 +), *Carex lasiocarpa* (6 +), *Cephalozia bicuspidata* (25 r), *Chiloscyphus pallescens* (9 r), *Dicranum* sp. (22 +), *Drepanocladus polygamus* (23 r), *Eriophorum vaginatum* (10 +), *Galium trifidum* (21 +, 26 +), *Galium uliginosum* (20 r), *Lophozia silvicola* (10 r), *Meesia triquetra* (27 +, 38 +), *Pedicularis karoi* (25 +), *Plagiomnium ellipticum* (22 +, 23 +), *Ptilidium ciliare* (6 +), *Pyrola minor* (20 r, 25 +), *Rubus chamaemorus* (3 +), *Salix lapponum* (11 +), *Scapania irrigua* (29 +), *Schljakovianthus quadrilobus* (6 +), *Sphagnum fallax* (8 2a), *Sphagnum fuscum* (2 1), *Sphagnum girgensohnii* (8 +), *Sphagnum divinum* (10 1), *Tomentypnum nitens* (25 1), *Warnstorfia pseudostraminea* (16 r, 17 1).

Location. All relevés here and in the tables 2–5 were made on the territory of the Numto Nature Park, Khanty-Mansi Autonomous Area, Beloyarskiy district.

GPS coordinates (WGS 84) (N, E) and **dates**; **1** – 63.37091, 70.89349, 16.08.2017; **2** – 63.37174, 70.89498, 16.08.2017; **3** –. 63.44136, 70.75632, 19.10.2017; **44** – 63.44537, 70.75974, 17.08.2017; **5** – 63.44252, 70.75519, 17.08.2017; **6** – 63.40500, 70.84354, 19.08.2017; **7** – 63.36689; 70.87840; 21.08.201; **8** – 63.36633, 70.87771, 21.08.2017; **9** – 63.66733, 70.55554, 20.08.2017; **10** – 63.60206, 70.59440, 12.08.2022; **11** – 63.40500, 70.84354, 19.08.2017; **12** – 63.64534, 70.79663, 17.08.2022; **13** – 63.60173, 70.59407, 12.08.2022; **14** – 63.64528, 70.79639, 17.08.2022; **15** – 63.64333, 70.79694, 17.08.2022; **16** – 63.36771, 70.88261, 21.08.2017; **17** – 63.60194, 70.59389, 12.08.2022; **18** – 63.62132, 70.71068, 21.08.2017; **19** – 63.66159, 70.71503, 16.08.2022; **20** – 63.36771, 70.88261, 21.08.2017; **21** – 63.60611, 70.60278, 12.08.2022; **22** – 63.60639, 70.60260, 12.08.2022; **23** – 63.60619, 70.60307, 12.08.2022; **24** – 63.66167, 70.71500, 16.08.2022; **25** – 63.66181, 70.71441, 16.08.202; **26** – 63.61468, 70.60702, 13.08.2022; **27** – 63.61444, 70.60694, 13.08.2022; **28** – 63.61444, 70.60694, 13.08.2022; **29** – 63.61500, 70.60667, 13.08.2022; **30** – 63.61468, 70.60702, 13.08.2022; **31** – 63.61444, 70.60694, 13.08.2022; **32** – 63.61444, 70.60694, 13.08.2022; **33** – 63.61444, 70.60694, 13.08.2022; **34** – 63.61444, 70.60694, 13.08.2022; **35** – 63.61444, 70.60694, 13.08.2022.

Authors: E.D. Lapshina – rel. 1,3–4, 6-8, 10, 12,18–19, 22–23, 27, 32–34; I.V. Filippov – rel. 2, 5, 9, 11, 13, 16, 20, 25–26, 30; G.N. Ganasevich – rel. 15, 17, 21, 24, 29; E.L. Verevkina – rel. 14, 28, 31, 35.

Diagnostic species (next to the name of the taxon): **S.–C.c. – Sphagno–Caricion canescentis, S.w.-T.n. – Sphagno warnstorfii–Tomentypnion nitentis**. *(shaded) – nomenclatural type (holotype).

Alliance **Sphagno–Caricion canescentis**

The alliance combines the mesotrophic and meso-oligotrophic sedge-*Sphagnum* and sedge-herb-*Sphagnum* communities of transition mires covering a wide range of habitats from nutrient poor to moderately rich ones with acidic to slightly acidic substrate reaction.

Diagnostic species of the order in Western Siberia include *Carex canescens*, *Eriophorum gracile*, *Epilobium palustre*, *Sphagnum fallax*, *S. flexuosum*, *S. obtusum*, and *S. riparium*.

In the Numto Nature Park, communities of the alliance Sphagno–Caricion canescentis develop in the valleys of large and small rivers, within extensive flat depressions where former thermokarst lakes (locally called "khasyrey") were present, and in various types of lake-mire and flat palsa mire complexes. Within this alliance, eight associations with subassociations and variants have been identified.

Sphagno riparii–Menyanthetum trifoliatae ass. nov. (Table 2, rel. 1–37; Table 8, syntaxa 5, 6; Figs 1D–C, 2, clusters 3.1, 3.2)

Holotypus: relevé 8 (author's number – 007E22nu) in Table 2, KhMAO, Beloyarsk District, Numto Nature Park, 12.08.2022, author E.D. Lapshina.

The association encompasses *Menyanthes-Sphagnum* and *Menyanthes*-sedge (*Carex rostrata*)-*Sphagnum* communities of mesotrophic fens and floating mats dominated by *Sphagnum*

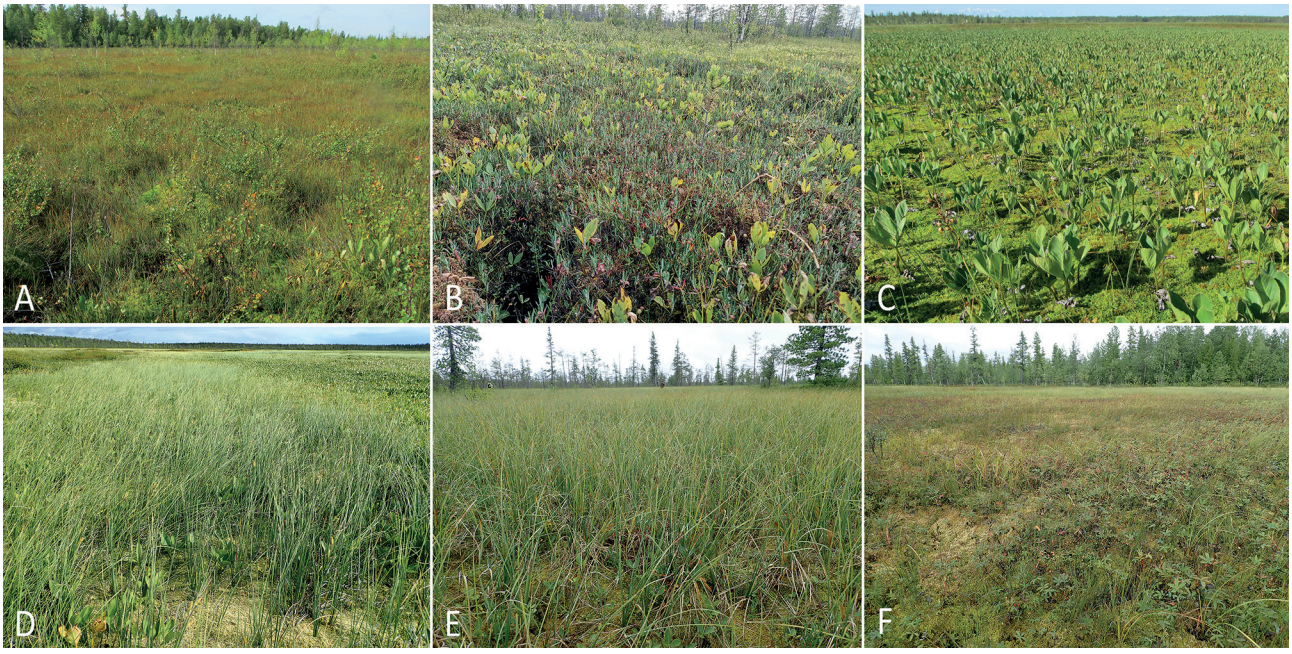

Figure 1 Photos of described mire communities in the Numto Nature Park. Alliances Sphagno warnstorfii–Tomentypnetalia and Sphagno–Caricion canescentis. A – Sphagno teretis–Betuletum nanae subass. typicum on moderately rich fen in small river valley; B – Sphagno warnstorfii–Caricetum dioicae var. Carex chordorrhiza on *Sphagnum warnstorfii* hummocks near the groundwater discharges at the sources of small brook; C – Sphagno riparii–Menyanthetum trifoliatae subass. typicum on the vast mesotrophic floating fen in river valley; D – Sphagno riparii–Menyanthetum trifoliatae suabass. caricetosum rostratae on the poor minerotrophic fen at the sources of brook; E – Sphagno fallacis–Caricetum rostratae at the periphery of mesooligotrophic mire in river valley; F – Sphagno obtusi–Comaretum palustris subass. sphagnetosum miri dominated by *Sphagnum mirum* on mesotrophic sedge-herb peat moss fen at the sources of small brook

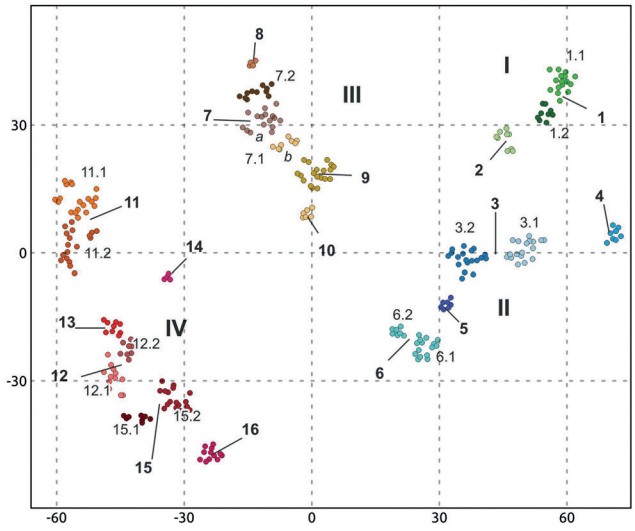

Figure 2 Ordination of the described syntaxa. Ordination is performed in the relative axes by non-linear mapping of the multidimensional feature space onto the 2D-plane by the t-SNE method. I – Sphagno warnstorfii–Tomentypnion nitentis. 1 – Sphagno teretis–Betuletum nanae: 1.1 – subass. typicum, 1.2. – subass. sphagnetosum warnstorfii; 2 – ass. Sphagno warnstorfii–Caricetum dioicae var. Carex chordorrhiza; II – Sphagno–Caricion canescentis. 3 – Sphagno riparii–Menyanthetum trifoliatae: 3.1 – subass. typicum, 3.2 – subass. caricetosum rostratae; 4 – Sphagno riparii–Eriophoretum russeoli; 5 – Sphagno fallacis–Caricetum rostratae; 6 – Sphagno obtusi– Comaretum palustris: 6.1 – subass. typicum, 6.2. – subass. sphagnetosum miri; III – Stygio–Caricion limosae. 7 – Utriculario ochroleuco–Caricetum limosae: 7.1 – subass. typicum (a – typica, b – inops), 7.2 – subass. warnstorfietosum exannulatae; 8 – *Carex limosa–Warnstorfia exannulata* com. type; 9 – Sphagno compacti–Caricetum limosae; 10 – Cladopodiello–Trichophoretum cespitosi subass. sphagnetosum compacti; IV – Scheuchzetion palustris. 11 – Scheuchzerio palustris–Sphagnetum jensenii: 11.1 – subass. typicum, 11.2 – subass. sphagnetosum majoris; 12 – Carici rotundatae–Sphagnetum lindbergii: 12.1 – subass. typicum, 12.2 – subass. eriophoretosum russeoli; 13 – Carici limosae–Sphagnetum lindbergii subass. eriophoretosum russeoli; 14 – Eriophoro russeoli–Warnstorfietum fluitantis; 15 – Carici rotundatae–Sphagnetum baltici: 15.1 – subass. typicum, 15.2 – subass. eriophoretosum russeoli; 16 – Eriophoro vaginati–Sphagnetum baltici

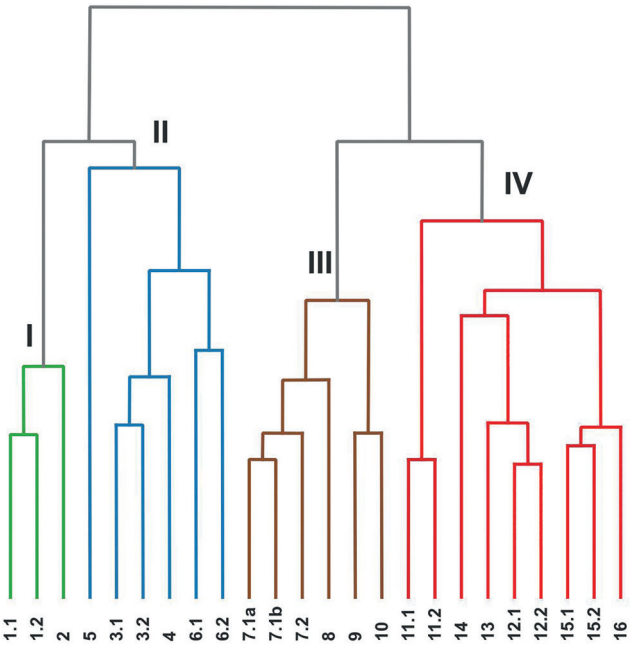

Figure 3 The similarity of syntaxa of the class Scheuchzerio–Caricetea nigrae in the Numto Nature Park represented for the northern taiga zone of Western Siberia, established by the Complete-linkage clustering (Squared Euclidean distances). The numbers of syntaxa correspond to the numbers in Fig. 2.

riparium. These communities are associated with areas of mineral poor groundwater discharge.

Synonyms and similar syntaxa: *Carex rostrata–Sphagnum riparium*-Ass. Osvald 1925, *Menyanthes trifoliata–Sphagnum riparium*-Ass. Warén 1926 [Art. 3d], Sphagnetum riparii caricetosum rostratae Dahl 1956, *Caricetum rostratrae* subass. von Sphagnum riparium Dierssen 1982 [Art. 5], Menyantho–Caricetum limosae subass. sphagnetosum riparii (Smagin 1999b, 2003) [Art. 2b, 5].

Diagnostic speies: *Carex rostrata*, *Menyanthes trifoliata* (dom.), *Sphagnum riparium* (dom.).

Structure and composition. The communities are species-poor (from 4 to 10 species in a single relevé). The herb layer is typically dominated by *Menyanthes trifoliata*, ranging from 10 to 20 cm in height, with a varying projected cover of 15–60 %. As occasional components and in low abundance, *Comarum palustre*, *Naumburgia thyrsiflora*, cottongrasses – *Eriophorum gracilis*, *E. polystachion*, sedges *Carex limosa*, *C. canescens*, and *Oxycoccus palustris* are present. Often, a more or less dense upper layer dominated by *Carex rostrata* develops in the communities. This association is characterized by the absolute dominance of *Sphagnum riparium* in the moss layer, forming flat, even floating carpets.

Distribution and ecology. Within the nature park, this association is the most common and widely spread across relatively large mesotrophic mire complexes in river valleys. These complexes can range up to several hundred meters and are often located on the sites of former lakes and peat-filled stream valleys. The water level usually remains at a depth of 1–5 cm.

Based on the appearance, determined by the dominant species in the grass layer, two subassociations have been identified within the association – typicum and caricetosum rostratae. The subassociation communities occur often together alternating across the mire complexes.

Sphagno riparii–Menyanthetum trifoliatae typicum subass. nov. (Table 2, rel. 1–20; Table 8, syntaxon 5; Figs 1C, 2, cluster 3.1)

The subassociation encompasses *Menyanthes*-peat moss communities of mesotrophic fens and floating mats with the dominance of *Sphagnum riparium*.

Holotypus: relevé 8 (author's number – 007E22nu) in Table 2, KhMAO, Beloyarsk District, Numto Nature Park, 12.08.2022, author E.D. Lapshina.

Synonyms and similar syntaxa: *Menyanthes trifoliata–Sphagnum riparium*-Ass. Warén 1926 [Art. 3d], Menyantho–Caricetum limosae subass. sphagnetosum riparii (Smagin 1999b, 2003) [Art. 2b, 5], Menyantho–Caricetum limosae subass. sphagnetosum riparii (Lapshina 2010) [Art. 5].

Diagnostic species: *Carex limosa*, *Eriophorum gracile*, *Menyanthes trifoliata* (dom.), *Sphagnum riparium* (dom.).

Structure and composition. Subassociation is characterized by a simple structure of the herb layer, dominated by *Menyanthes trifoliata*, with a minor presence of other species and a continuous carpet of *Sphagnum riparium* in the moss layer (Fig. 1C).

Note. In terms of composition and structure, the *Menyanthes*-peat moss communities dominated by *Sphagnum riparium* in the nature park are similar to those in the north of European part of Russia and in the Surgut Polis'e in the subzone of the middle taiga of Western Siberia (Smagin 1999b, 2003). They differ from the communities described in the southern forest zone of Western Siberia (Lapshina 2010) by their low species richness and the presence of hypoarctic species such as *Eriophorum russeolum* and *Sphagnum lindbergii*. Similar communities, which can also be assigned to this association, are often found in northern Norway, but they do not occur in Iceland and the British Isles (Dierssen 1982).

Table 2. Association Sphagno riparii–Menyanthetum trifoliatae (1) of the alliance Sphagno–Caricion canescentis. Mesotrophic sedge-*Menyanthes*-peat moss fens dominated by *Sphagnum riparium*. 1–20 – Sphagno riparii–Menyanthetum trifoliatae subass. typicum (1a), 21–37 – subass. caricetosum rostratae (1b). Abbreviations: (a) – tree layer, (a3) – undergrowth of trees.

Subassotiation	***typicum* (1a)**																				***caricetosum rostratae* (1b)**																	**Constancy and abundance**		
Plant cover, %																																									
dwarf shrubs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0			
herbs	70	25	50	50	25	40	30	60	30	35	20	25	60	30	40	70	40	30	35	40	30	50	65	25	40	35	50	35	40	25	50	40	65	80	70	30	40			
moss	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100			
Number of species	5	6	9	8	5	5	5	9	4	7	7	4	5	5	5	4	5	10	8	9	7	5	2	10	5	6	8	6	3	8	3	5	4	4	6	4	8			
Relevé nr. by author	033E22nu	332E17nu	348E17nu	344E17nu	035F17nu	040F17nu	090F17nu	007E22nu	033F17nu	044E22nu	005F22nu	034F22nu	026G22nu	034G22nu	014V22nu	022V22nu	356E17nu	005G22nu	351E17nu	006E22nu	062F06nu	073E22nu	376a17nu	065a06nu	024F22nu	023V22nu	056E06nu	035G22nu	025G22nu	035F22nu	375E17nu	032F17nu	046E22nu	031E22nu	403E17nu	045a17nu	046F17nu			
Relevé nr. in the table	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8***	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**1a**	**1b**	**1**
Diagnostic species of the ass. Sphagno riparii–Menyanthetum trifoliatae																																								
Sphagnum riparium **S.-C.c.**	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	**V⁵**	**V⁵**	**V⁵**
Menyanthes trifoliata **S.-C.**	4	2b	3	3	2b	3	3	4	3	3	2b	2b	3	2b	3	4	3	2b	2b	3	·	·	·	r	1	1	1	2a	2b	2a	2b	2b	3	3	2a	1	1	**V³**	**V¹**	**V³**
Carex limosa **S.-C.**	+	1	+	1	+	·	·	1	·	+	·	·	1	1	+	·	1	·	+	+	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	r	**IV⁺**	**I**	**III⁺**
Eriophorum gracile	1	·	+	·	1	·	·	1	·	+	+	1	1	·	1	·	·	1	·	1	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	**III⁺**	·	**III⁺**
Diagnostic species of the subass. S.r.–M.t. caricetosum rostratae																																								
Carex rostrata **S.-C.**	+	·	·	·	·	1	1	·	·	·	·	·	+	·	1	·	·	·	·	·	3	3	4	2b	3	3	3	2b	2b	2b	3	2a	3	3	2b	2b	2b	**II**	**V³**	**IV³**
Diagnostic species of the Sphagno–Caricion canescentis																																								
Carex canescens	·	·	+	·	+	·	·	+	+	·	·	·	·	·	·	·	·	1	·	·	·	·	·	1	·	·	+	·	·	·	·	+	·	·	·	·	·	**II**	**I**	**II**
Comarum palustre	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1	·	·	·	·	+	+	·	·	1	·	+	·	·	·	·	3	·	·	**I**	**II**	**II**
Carex magellanica subsp. *irrigua*	·	·	+	·	·	·	·	·	+	+	·	·	·	·	·	·	·	·	+	+	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	**II**	**I**	**II**
Sphagnum fallax	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1	2a	2b	·	**I**	**I**
Sphagnum obtusum	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1	2a	2a	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	**I**	·	**I**
Diagnostic species of the Scheuchzerio–Caricetea nigrae																																								
Oxycoccus palustris	·	1	1	1	·	1	+	+	·	1	+	·	·	+	·	1	·	+	·	+	·	+	·	·	·	·	·	+	·	+	·	1	1	r	·	·	2a	**IV⁺**	**III**	**IV⁺**
Eriophorum angustifolium	·	·	r	1	·	·	r	+	·	1	·	+	·	1	·	1	+	·	r	·	+	·	·	r	+	·	·	·	·	·	·	·	·	·	·	·	·	**III**	**I**	**III**
Carex chordorrhiza	·	·	·	·	·	r	·	·	·	·	·	·	·	·	·	·	·	·	2a	·	·	·	·	1	·	·	·	+	·	+	·	·	·	·	·	·	·	**I**	**I**	**II**
Andromeda polifolia	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1	·	·	·	+	·	·	·	·	·	·	·	·	**I**	**I**
Other species																																								
Eriophorum russeolum	·	1	·	+	·	·	·	+	·	·	+	·	·	·	·	·	·	+	·	·	·	+	·	·	·	1	·	·	·	·	·	·	·	·	·	·	·	**II**	**I**	**II**
Warnstorfia fluitans	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	1	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	**I**	·	**I**
Sphagnum majus	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1	·	·	1	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	**I**	**I**	**I**
Sphagnum lindbergii	·	1	·	1	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	2a	**I**	**I**	**I**
Calamagrostis purpurea	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	**I**	**I**
Straminergon stramineum	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	r	**I**	·	**I**
Sphagnum jensenii	·	·	·	·	·	·	·	·	·	·	1	·	·	·	·	·	2a	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	**I**	·	**I**
Polytrichum jensenii	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	**I**	**I**
Scheuchzeria palustris	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	**I**	·	**I**

Note. Species found in 1 relevé: *Betula nana* (21 +), *Calamagrostis neglecta* (20 r), *Carex aquatilis* (35 1), *Carex rotundata* (24 r), *Chamaedaphne calyculata* (21 r), *Epilobium palustre* (3 +r), *Naumburgia thyrsiflora* (24 +), *Polytrichastrum longisetum* (27 r).

GPS coordinates (WGS 84) (N, E) and **dates**: **1** – 63.61472, 70.62222, 13.08.2022; **2** – 63.30725, 70.70712, 16.08.2017; **3** – 63.37245, 70.88750, 16.08.2017; **4** – 63.37165, 70.89426, 16.08.2017; **5** –63.30812, 70.75513, 16.10.2017; **6** – 63.37174, 70.89498, 16.08.2017; **7** – 63.66701, 70.58156, 20.08.2017; **8** – 63.60430, 70.59520, 12.08.2022; **9** – 63.30812, 70.75513,16.10.2017; **10** – 63.65223, 70.58169, 14.08.2022; **11** – 63.60427, 70.59566, 12.08.2022; **12** – 63.65254, 70.58124, 14.08.2022; **13** – 63.61500, 70.61778, 13.08.2022; **14** – 63.65250, 70.58111, 14.08.2022; **15** – 63.61472, 70.61722, 13.08.2022; **16** – 63.65250, 70.58111, 14.08.2022; **17** – 63.52906, 70.63738, 17.08.2017; **18** – 63.60444, 70.59556, 12.08.2022; **19** – 63.37245, 70.88750, 16.08.2017; **20** – 63.60484, 70.59957, 12.08.2022; **21** – 63.67967, 70.87125, 19.07.2006; **22** – 63.67950, 70.55415, 16.08.2022; **23** – 63.44587, 70.76073, 17.08.2017; **24** – 63.62912, 70.92798, 20.07.2006; **25** – 63.61583 70.61142, 13.08.2022; **26** – 63.65167, 70.58111, 14.08.2022; **27** – 63.67978, 70.87112, 19.07.2006; **28** – 63.65194, 70.58056, 14.08.2022; **29** – 63.61583, 70.61111, 13.08.2022; **30** – 63.65175, 70.58074, 14.08.2022; **31** – 63.44537, 70.75974, 17.08.2017; **32** – 63.30812, 70.75513, 16.10.2017; **33** – 63.65172, 70.58149, 14.08.2022; **34** – 63.61222, 70.60833, 13.08.2022; **35** – 63.40493, 70.84521, 19.08.2017; **36** – 63.52971, 70.63847, 17.08.2017; **37** – 63.52971, 70.63847, 17.08.2017.

Authors: E.D. Lapshina – rel. 1–4, 8, 10, 17, 19–20, 22–24, 27, 31, 33–36; I.V. Filippov – rel. 5–7, 9. 11–12, 21, 25, 30, 32, 37; G.N. Ganasevich – rel. 13–15, 18, 28–29; E.L. Verevkina – rel. 15–16, 26.

Diagnostic species (next to the name of the taxon): **S.-C.c. – Sphagno–Caricion canescentis, S.-C. – Scheuchzerio–Caricetea nigrae.** *(shaded) – nomenclatural type (holotype).

Sphagno riparii–Menyanthetum trifoliatae subass. caricetosum rostratae (Osvald 1925) **stat. nov.** (Table 2, rel. 21–37, Table 8, syntaxon 6; Figs 1D, 4, cluster 3.2).

The subassociation encompasses waterlogged sedge-*Sphagnum* and *Menyanthes*-sedge-*Sphagnum* communities of mesotrophic and meso-oligotrophic fens and floating mats dominated by *Carex rostrata* in the herb layer and *Sphagnum riparium* in the moss layer.

Similar communities are first mentioned by Osvald (1925: 44) under the name *Carex rostrata–Sphagnum riparium*-Ass. in northern Sweden. We validate the name of this association as it conforms to the requirements of the Uppsala School syntaxa Code [3d, ICPN] (Theurillat et al. 2021), with a reduction in the rank of the association to that of a subassociation.

Lectotypus hoc. loco: The sole description by H. Osvald (Osvald 1925, p. 44) is sufficient in terms of an original diagnosis [ICPN, Art. 2b, 7], which includes a list of species with their abundances on the Braun-Blanquet scale (species names have been updated to current nomenclature): *Menyanthes trifoliata* – 3, *Oxycoccus palustris* – 2, *Carex aquatilis* – 1, *Carex rostrata* – 4, *Eriophorum angustifolium* – 1, *Rubus chamaemorus* – 1, *Sphagnum riparium* – 5, *Straminergon stramineum* – 1.

Diagnostic species: *Carex rostrata* (dom.), *Menyanthes trifoliata*, *Sphagnum riparium* (dom.).

Synonyms and similar syntaxa: *Carex rostrata-Sphagnum riparium*-Ass. Osvald 1925, Sphagnetum riparii caricetosum rostratae Dahl 1956, Caricetum rostratrae subass. von Sphagnum riparium Dierssen 1982 [Art. 5].

Structure and composition: The grass cover is relatively dense (30–80 %), forming a 1–2-layered structure. The upper

30–40 cm high sublayer formed by *Carex rostrata* (20–40 %) (Fig. 1D). Besides the dominant sedge species, *Menyanthes trifoliata* often contributes significantly (up to 20–30 %), forming the lower 15–20 cm high sublayer. In smaller proportions, it is occasionally accompanied by *Carex canescens*, *C. chardorrhiza*, *Comarum palustre*, *Eriophorum angustifolium*, and *Oxycoccus palustris*. The moss layer is dominated by *Sphagnum riparium*, forming a continuous moss carpet. Occasionally, slight additions to this are Sphagnum jensenii and *S. lindbergii*. Overall, these communities are characterized by low species diversity. The number of species in one relevé varies from 3 to 10, typically 4–6.

Distribution and ecology: This subassociation occupies waterlogged areas of meso-oligotrophic peat mires in the headwaters of rivers and brooks, occasionally being part of oligotrophic *Sphagnum mires* and flat-palsa mire complexes.

Sphagno riparii–Eriophoretum russeoli ass. nov. (Table 3, rel. 1–10; Table 8, syntaxon 4; Fig. 2, cluster 4)

Holotypus: relevé 6 (author's number 326E17nu) in Table 3, KhMAO, Beloyarsk District, Numto Nature Park, 16.08.2017, author E.D. Lapshina.

This association encompasses communities where cottongrass (*Eriophorum russeolum*) and *Sphagnum riparium* dominate. They develop in moist elevated areas of flat palsa complexes in the northern taiga zone and forest-tundra of Western Siberia.

Diagnostic species: *Eriophorum russeolum* (dom.), *Sphagnum riparium* (dom.).

Structure and composition: These communities are species-poor (2–5 species in relevé) and reveal a simple and homogenous structure. The 15–20 cm high grass layer is formed of *Eriophorum russeolum*, with a cover ranging from 5 to 40 %, more commonly 15–20 %. *Sphagnum riparium* dominates in the moss layer, occasionally accompanied by slight additions of *Sphagnum jensenii* and *S. lindbergii*. Rare stems of *Oxycoccos palustris* spread across the moss surface.

Distribution and ecology: The communities of this association are found at the contact zones with thawing peat palsa and waterlogged hollow within flat palsa mire complexes, without occupying large areas. The water level in the habitats is around 1–5 cm below the surface.

Note: Similar communities have been observed in the northern European part of Russia, where they were considered part of an invalid association Sphagno–Eriophoretum russeolii [Art. 2b, 5, 10] (subass. sphagnetosum lindbergii, sphagnetosum majoris) (Smagin 1999a).

Sphagno fallacis–Caricetum rostratae Osvald ex Lapshina **nom. ivers. mut.** (Table 3, rel. 11–17; Table 8, syntaxon 7; Figs 1E, 2, cluster 5)

Lectotypus: relevé 18, Osvald 1923, pp. 218–219, *Carex rostrata–Sphagnum apiculatum*-Ass., South Sweden.

This association comprises meso-oligotrophic sedge-*Sphagnum* communities dominated by *Carex rostrata* and *Sphagnum fallax*, occasionally *S. flexuosum*, on laggs of raised bogs and transitional fens in the boreal zone of Eurasia.

Carex rostrata communities with a dominance of *Sphagnum fallax* have been repeatedly described from various regions of Western and Eastern Europe. Dierssen (1982) consolidated them into a large association called Caricetum rostaratae (Osvald 1923) Dierssen 1982. In this process, he chose a syntaxon as the nomenclatural type rather than a specific relevé (ICPN Art. 2b, 3d, 5). He included various *Carex rostrata* communities with dominance *Scorpidium scorpioides*, *Warnstorfia exannulata*, *Sphagnum lindbergii*, *S. riparium*, *S. majus*, *S. papillosum*, and others. Such communities are classified into different alliances and orders in the contemporary classification of European mire vegetation (Mucina et al. 2016). Given the widespread occurrence of communities dominated by *Carex rostrata* and *Sphagnum fallax*, we propose to consider the association in its original scope.

The name *Carex rostrata-Sphagnum apiculatum* Association (Osvald 1923) from Southern Sweden has been validated, as it fulfills the requirements of the Uppsala School's codes [3d, ICPN]. The name has been inverted and species names have been updated to current nomenclature. The lectotype chosen as the nomenclatural type is rel. 18 in Osvald 1923: 218–219 (lectotypus hoc loco). The names of species are updated according to contemporary nomenclature, and their abundance is given on the Braun-Blanquet scale: *Andromeda polifolia* – 1, *Carex canescens* – 1, *C. limosa* – 1, *C. rostrata* – 4, *Menyanthes trifoliata* – 2, *Oxycoccus palustris* – 1, *Sphagnum fallax* – 5, *Straminergon strmineum* – 1.

Diagnostic species: *Carex rostrata* (dom.), *Sphagnum fallax* (dom.).

Synonyms and similar syntaxa: *Carex rostrata–Sphagnum apiculatum* Osvald 1923, *Carex rostrata–Sphagnum apiclatum*-Ass. Warén 1926, *Carex rostrata–Sphagnum apiculatum* (Abramova 1951), *Carex rostrata–Sphagnum fallax* (Boch & Vasilevich 1980), Caricetum rostratae subass. sphagnetosum fallacis (Boch & Smagin 1993), *Carex rostrata–Sphagnum fallax* (Galanina 2004, Kuznetsov 2005, Blagoveshchenskiy 2006, Goncharova 2007), Sphagno fallacis–Caricetum rostratae Osvald 1923 ex Rybniček 1984 (Lapshina 2010), *Carex rostrata sphagnetosum fallacis* (Osvald 1923) Dierssen 1982 sensu Zelenkvich et al. 2016.

Structure and composition. These association communities are characterized by a relatively dense (25–50 %) layer of *Carex rostrata*, reaching a height of 30–40 cm (Fig. 1E), with dominance or significant participation of *Sphagnum fallax* in the moss layer. Alongside the dominant sedge species, these communities usually contain *Menyanthes trifoliata* and *Oxycoccus palustris* in moderate abundance. More nutrient-demanding species such as *Comarum palustre*, *Equisetum fluviatile*, *Eriophorum angustifolium*, and *Naumburgia thyrsiflora* are rare and less abundant. Shrubby vegetation includes occurrences of *Andromeda polifolia*, and in some cases, a sparse layer of dwarf birch (*Betula nana*) can occur.

Distribution and ecology. This association has an extensive Euro-Asian range; however, in the northern taiga zone, its communities become relatively rare compared to the mires of Northern Europe, the European part of Russia, and the southern regions of Western Siberia. In the nature park, these communities are sporadic, found at the periphery of mesotrophic and mesooligotrophic mires in river valleys, occupying relatively large areas.

Note. Mesotrophic communities of *Carex rostrata* with peat mosses (*Sphagnum flexuosum*, *S. fallax*, *S. teres*), described in the temperate and nemoral zones of Central and Eastern Europe (Steffen 1931, Tüxen 1937, Passarge 1964, Rybniček 1974), have been merged into a large association, Sphagno recurvi–Caricetum rostratae Steffen 1931, in the recent vegetation overview of the Czech Republic (Chytrý 2011). This association also includes less species-rich mesooligotrophic communities of *Carex rostrata–Sphagnum fallax* from Northern Europe (Osvald 1923, Warén 1926), which noticeably differ in terms of ecology, species composition, and structure from those described in Central Europe. Based on this, as well as considering the extensive distribution of such boreal communities, ranging from northern Scandinavia to Western Siberia and Baikal region, we have recognized them as a distinct association, Sphagno fallacis–Caricetum rostratae Osvald 1923, with an alternative nomenclatural type.

Sphagno obtusi–Comaretum palustris ass. nov. (Table 3, rel. 18–39; Table 8, syntaxon 8, 9; Fig. 2, clusters 6.1, 6.2).

Holotypus: relevé 20 (author's number 046F22nu) in Table 3, KhMAO, Beloyarsk District, Numto Nature Park, 15.08.2022, author I.V. Filippov.

The association encompasses *Menyanthes*-peat moss and sedge-herb-peat moss communities dominated by *Sphagnum obtusum* in transitional fens of the boreal zone of Eurasia.

Synonyms and similar syntaxa: *Carex limosa–Sphagnum obtusum* Osvald 1923; Menyantho–Caricetum limosae subass. sphagnetosum obtusi (Smagin 1999b) [Art. 2b, 5].

Diagnostic species: *Carex chordorrhiza*, *Comarum palustre*, *Menyanthes trifoliata*, *Sphagnum obtusum* (dom.).

Table 3. Associations of the alliance Sphagno–Caricion canescentis. Meso-oligotrophic and mesotrophic sedge-herb-peat moss fens dominated by *Sphagnum riparium*, *S. obtusum* and *S. mirum*. 1–10 – Sphagno riparii–Eriophoretum russeoli (1); 11–17 – Sphagno fallacis–Caricetum rostratae (2); 18–39 – Sphagno obtusi–Comaretum palustris (3): 18–32 – subass. typicum (3a), 33–39 – subass. sphagnetosum miri (3b).

Associations	Sphagno riparii–Eriophoretum russeoli (1)										Sphagno fallacis–Caricetum rostratae (2)							Sphagno obtusi–Comaretum palustris (3)																							Constancy and abundance				
Subassotiations	–										–							typicum (3a)															sphagnetosum miri (3b)											
Plant cover, %																																												
dwarf shrubs	0	0	0	0	0	0	0	0	0	0	0	15	0	0	0	20	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0					
herbs	10	10	10	25	20	30	25	40	10	25	50	40	50	40	60	40	30	40	25	20	30	20	55	30	60	45	55	30	30	30	45	40	55	65	35	35	30	40	70					
moss	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	60	100	100	100					
Number of species	2	4	3	2	4	5	4	4	3	4	4	7	5	7	5	9	8	9	5	10	5	5	9	5	8	9	10	9	8	8	11	11	14	11	8	15	13	13	15					
Relevé nr. by author	019F06nu	036F22nu	123F06nu	022G22nu	325E17nu	326E17nu	326a17nu	032E22nu	021F22nu	024V22nu	357E17nu	399E17nu	422E17nu	433E17nu	005E22nu	009E22nu	007G22nu	047G22nu	042F22nu	046F22nu	007F22nu	043G22nu	033V22nu	042G22nu	349E17nu	037V22nu	061E22nu	054E22nu	050F22nu	029V22nu	066E22nu	053G22nu	093E22nu	094E22nu	072F22nu	073F22nu	080G22nu	081G22nu	057V22nu					
Relevé nr. in the table	**1**	**2**	**3**	**4**	**5**	**6***	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20***	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33***	**34**	**35**	**36**	**37**	**38**	**39**	**1**	**2**	**3a**	**3b**	**3**
Diagnostic species of the ass. Sphagno riparii–Eriophoretum russeoli																																												
Eriophorum russeolum **S.p.**	2a	1	2a	2b	2b	2b	2b	3	2a	2b	·	·	·	·	·	·	·	·	1	·	·	1	·	1	·	+	·	+	·	1	+	·	·	·	·	·	·	·	·	**V²ᵇ**	·	**III**	·	**II**
Sphagnum riparium **S.-C.c.**	5	5	5	5	5	5	5	5	5	5	1	·	·	·	·	·	·	·	·	·	·	·	1	·	·	·	·	·	·	·	·	·	1	1	·	·	·	·	2a	**V⁵**	**I**	**I**	**III**	**I**
Diagnostic species of the ass. Sphagno fallacis–Caricetum rostratae																																												
Carex rostrata	·	·	·	·	·	·	·	·	·	·	**3**	**3**	**3**	**3**	**3**	**3**	**2b**	1	·	+	2a	·	2a	·	·	2a	1	·	2b	·	1	1	·	·	·	+	·	·	1	·	**V³**	III¹	II	IIIʳ
Sphagnum fallax	·	·	·	·	·	·	·	1	·	·	5	5	5	5	5	5	5	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	**I**	**V⁵**	·	·	·
Diagnostic species of the ass. Sphagno obtusi–Comaretum palustris																																												
Sphagnum obtusum **S.-C.c.**	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	5	5	5	5	5	5	5	5	5	5	5	5	4	4	4	1	2b	2a	3	3	3	3	·	·	**V⁵**	**V³**	**V⁵**
Comarum palustre	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	1	1	·	1	·	·	1	·	·	1	1	+	+	·	1	1	3	3	2b	2b	2b	2b	3	·	**II**	IV⁺	**V²ᵇ**	**IV¹**
Carex limosa **S.-C.**	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	+	·	+	·	1	1	1	r	1	1	+	1	1	2a	2b	2a	+	2a	1	1	·	·	**V¹**	**V²ᵃ**	**V¹**
Carex chordorrhiza	·	·	·	·	·	·	·	·	·	·	·	·	·	r	·	·	·	1	·	+	·	·	·	·	·	1	+	+	·	+	+	1	1	+	·	+	·	+	+	·	**I**	III⁺	IV⁺	III⁺
Menyanthes trifoliata **S.-C.**	·	·	·	·	·	·	·	·	·	·	·	·	+	1	2b	+	1	3	2b	2a	2b	2b	3	2b	4	3	3	3	2b	2a	3	2b	·	·	·	·	·	·	1	·	IV⁺	**V²ᵇ**	**I**	IV²ᵇ
Sphagnum majus	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1	2a	2a	3	3	3	·	·	·	·	·	·	·	·	·	II²ᵇ	·	**II**
Diagnostic species of the subass. S.o. –C.p. sphagnetosum miri																																												
Sphagnum mirum	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	5	5	5	2b	4	3	3	·	·	·	**V⁴**	**II**
Straminergon stramineum	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1	·	·	·	·	·	·	·	1	+	+	+	1	1	1	·	·	**I**	**V¹**	**II**
Calamagrostis neglecta	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	1	·	+	+	·	·	·	·	·	III⁺	**I**
Diagnostic species of the Sphagno–Caricion canescentis																																												
Epilobium palustre	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1	·	+	·	·	+	·	·	·	·	·	·	·	·	·	+	1	·	·	1	1	·	·	·	**I**	III⁺	**II**
Carex canescens	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	r	·	·	+	+	·	·	·	+	+	·	·	·	·	·	·	·	·	·	**II**	·	**II**
Eriophorum gracile	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	+	·	·	·	1	·	·	·	·	1	·	1	·	·	·	·	·	·	·	·	·	**II**	·	**II**
Carex magellanica subsp. *irrigua*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	r	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	+	·	+	·	·	**I**	**I**	**II**	**I**
Diagnostic species of the Scheucherion palustris																																												
Sphagnum lindbergii	·	·	2a	·	·	1	·	·	2a	·	1	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	**II**	**I**	·	·	·
Sphagnum jensenii	·	·	·	·	1	1	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	**III**	·	·	·	·
Scheuchzeria palustris	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	+	·	+	+	·	·	·	·	·	·	·	·	·	**II**	·	**I**
Diagnostic species of the Scheuchzerio–Caricetea nigrae																																												
Oxycoccus palustris	·	1	·	·	1	2a	1	+	·	1	·	2a	2a	1	+	2b	1	+	·	+	·	·	1	+	r	+	·	+	+	1	+	1	1	+	1	1	1	1	1	IV⁺	**V¹**	IV⁺	**V¹**	**V⁺**
Eriophorum angustifolium	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	+	·	·	1	+	·	+	·	+	+	·	·	·	·	+	·	·	r	+	+	·	·	**I**	**II**	IIIʳ	**III**
Andromeda polifolia	·	·	·	·	·	·	·	·	·	·	·	1	·	2a	+	2a	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	2a	·	·	·	·	III⁺	·	**II**	**I**
Other species																																												
Helodium blandowii	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1	1	1	1	·	·	·	III¹	**I**
Betula nana	·	·	·	·	·	·	·	·	·	·	·	2a	·	·	·	2a	1	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	**III**	·	·	·
Sphagnum squarrosum	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1	·	1	·	·	·	1	·	·	·	**III**	**I**
Pseudobryum cinclidioides	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1	+	1	·	·	·	**III**	**I**
Carex diandra	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	1	+	·	·	·	**III**	**I**
Equisetum fluviatile	·	·	·	·	·	·	·	·	·	·	·	·	r	r	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	**II**	·	·	·
Naumburgia thyrsiflora	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	**II**	·	·	·
Cicuta virosa	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	**I**	·	**I**
Sphagnum angustifolium	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1	·	1	·	·	·	·	·	·	·	**II**	**I**
Stellaria crassifolia	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	+	·	·	·	·	·	**II**	**I**

Note. Species found in 1 relevé: *Carex rotundata* (12 +), *Drosera rotundifolia* (2 +), *Galium trifidum* (20 +), *Scapania irrigua* (21 r), *Scapania paludicola* (36 +), *Sphagnum divinum* (12 +), *S. teres* (36 1), *Warnstorfia fluitans* (39 1).

GPS coordinates (WGS 84) (N, E) and **dates**: **1** – 63.67798, 70.86702, 19.07.2006; **2** – 63.65156, 70.58004, 14.08.2022; **3** – 63.66007, 70.92693, 22.07.2006; **4** – 63.61278, 70.60833, 13.08.2022; **5** – 63.29233, 70.80096, 16.08.2017; **6** – 63.29233, 70.80096, 16.08.2017; **7** – 63.29233, 70.80096, 16.08.2017; **8**.61528, 70.62500, 13.08.2022; **9** – 63.61214, 70.60726, 13.08.2022; **10** – 63.65167, 70.57916, 14.08.2022; **11** – 63.52873, 70.63842, 17.08.2017; **12** – 63.45214, 70.71367, 19.08.2017; **13** – 63.36814, 70.87480, 21.08.2017; **14** – 63.62132, 70.71068, 21.08.2017; **15** – 63.60484, 70.59957, 12.08.2022; **16** – 63.59892, 70.59297, 12.08.2022; **17** – 63.59889, 70.59278, 12.08.2022; **18** – 63.67139, 70.57028, 15.08.2022; **19** – 63.66617, 70.57903, 15.08.2022; **20** – 63.67072, 70.57084, 15.08.2022; **21** –63.60173, 70.59407, 12.08.2022; **22** – 63.66639, 70.57861, 15.08.2022; **23** – 63.67111, 70.57028, 15.08.2022; **24** – 63.66611, 70.57917, 15.08.2022; **25** – 63.37245, 70.88750, 16.08.2017; **26** – 63.67944, 70.55417, 15.08.2022; **27** – 63.67162, 70.57111, 15.08.2022; **28** – 63.66625, 70.57876, 15.08.2022; **29** – 63.67950, 70.55333, 15.08.2022; **30** – 63.66611, 70.57861, 15.08.2022; **31** – 63.67950, 70.55415, 15.08.2022; **32** – 63.67833, 70.56250, 15.08.2022; **33** – 63.64555, 70.79528, 17.08.2022; **34** – 63.64555, 70.79528, 17.08.2022; **35** – 63.64565, 70.79507, 17.08.2022; **36** – 63.64565, 70.79507, 17.08.2022; **37** – 63.64556, 70.79528, 17.08.2022; **38** – 63.64556, 70.79528, 17.08.2022; **39** – 63.64556, 70.79528, 17.08.2022.

Authors: E.D. Lapshina – rel. 5-8, 11–16, 25, 27–28, 31, 33–34; I.V. Filippov – rel. 1–3, 9, 19–21, 29,35–36; G.N. Ganasevich – rel. 4, 17–18, 22, 24, 32, 37–38; E.L. Verevkina – rel. 10, 23, 26,30, 39.

Diagnostic species (next to the name of the taxon): **S.-C.c. – Sphagno–Caricion canescentis, S.-C. – Scheuchzerio–Caricetea nigrae, S.p. – Scheuchzerion palustris**. *(shaded) – nomenclatural type (holotype).

Structure and composition. The 15–20 (30) cm high grass layer is well developed (projected coverage varies between 20 and 60 %). Among the grasses, *Menyanthes trifoliata* dominates (20–60 %), often accompanied by *Carex limosa*, *C. rostrata*, and *Comarum palustre*. In lower abundance but with high constancy, species like *Carex chordorrhiza*, *Eriophorum angustifolium*, and *Oxycoccus palustris* are present. The moss layer dominated by *Sphagnum obtusum*, sometimes accompanied with *Sphagnum majus*.

Distribution and ecology. Communities of this association develop in mesotrophic fens situated in the valleys of rivers and brooks. These habitats are moderately moist and somewhat richer in terms of water and mineral nourishment compared to syntaxa dominated by *Sphagnum riparium* in the moss layer. The micro-relief is either flat or slightly undulating. The water level is typically at a depth of 3–10 (20) cm. They are less common within the park's territory compared to communities of the Sphagno riparii–Menyanthetum trifoliatae association dominated by *Sphagnum riparium*. Within the association, two subassociations have been identified.

Sphagno obtusi–Comaretum palustris typicum subass. nov. (Table 3, rel. 18–32; Table 8, syntaxon 8; Fig. 2, cluster 6.1)

Holotypus: relevé 20 (author's number 046F22nu) in Table 3, KhMAO, Beloyarsk District, Numto Nature Park, 15.08.2022, author I.V. Filippov.

Diagnostic species: *Comarum palustre*, *Menyanthes trifoliata* (dom.), *Sphagnum obtusum* (dom.).

Structure and composition. Same as in the association.

Distribution and ecology. Typical communities of this association are noted in the mires of the Arkhangelsk region (Smagin 1999b), where they are extremely rare. They also occur in the southern part of the forest zone of Western Siberia (Lapshina 2010).

Based on the composition of the moss layer within the association, two variants have been distinguished: typica and Sphagnum majus.

The variant typica (Table 3, 18–26) includes species-poor communities with a monodominant moss cover of *Sphagnum obtusum*.

The variant Sphagnum majus (Table 3, 27–32) is characterized by the consistent presence of *Sphagnum majus* in the moss layer (from 1 to 30 %).

Sphagno obtusi–Comaretum palustris sphagnetosum miri ass. nov. (Table 3, rel. 33–39; Table 8, syntaxon 9; Figs 1F, 2, cluster 6.2)

Holotypus: relevé 33 (author's number 093E22nu) in Table 3, KhMAO, Beloyarsk District, Numto Nature Park, 17.08.2022, author E.D. Lapshina.

The subassociation encompasses mesotrophic herb-peat moss communities dominated by the rare species of peat moss – *Sphagnum mirum* (Lapshina et al. 2023a).

Diagnostic species: *Calamagrostis neglecta*, *Comarum palustre*, *Epilobium palustre*, *Sphagnum mirum*, *Straminergon stramineum*.

Structure and composition. Dwarf shrub layer is absent or sporadically occurs on flat low hummocks and is formed by *Andromeda polifolia*. The grass layer is well-developed (projected cover ranging from 30 to 70 %) with dominance of *Comarum palustre* (15–40 %) (Fig. 1F). In smaller abundance, species like *Calamagrostis neglecta*, *Carex limosa*, *C. chordorrhiza*, *Epilobium palustre*, *Eriophorum angustifolium* are present. *Oxycoccus palustris* (1–5 %) spreads across the moss surface. The continuous moss cover consists mainly of *Sphagnum mirum* (20–80 %) along with *S. obtusum* (5–40 %), and a slight mixture of *Helodium blandowii*, *Sphagnum squarrosum*, *Straminergon stramineum*. The surface is coarsely wavy, and the water level is at a depth of 5–20 cm.

Distribution and ecology. Within the nature park, all relevés of communities of this subassociation have been conducted in areas where poor groundwater discharges occur within a single extensive mire complex situated at the source of a small stream. Similar communities in terms of ecology and species composition have also been identified in the "Malaya Sos'va" nature reserve and in the Pim River valley (a right tributary of the Ob River) in the subzone of middle taiga in Western Siberia (Lapshina et al. 2023a).

Extremely waterlogged oligotrophic and meso-oligotrophic fens vegetation

Alliance **Stygio–Caricion limosae**

The alliance belongs to the order Caricetalia nigrae and encompasses highly waterlogged oligotrophic and meso-oligotrophic sedge and sedge-moss-hepatic communities in transitional, aapa, and flat palsa mires within the boreal and subarctic zones of Eurasia (Lapshina et al. 2022). These communities develop in poor mires with neutral to slightly acidic substrate reaction.

Originally, such communities were placed into the alliance Rhynchosporion albae as defined by Koch in 1926, along with extremely acidic *Sphagnum*-dominated communities of wet hollows in ombrotrophic raised bog complexes. However, a recent revision of the mire vegetation syntaxa within the class Scheuchzerio–Caricetea nigrae in Europe by Czech phytocenologists has led to their recognition as a distinct and independent alliance. This new alliance's combination of species is statistically significant among other alliances at the alliance rank (Peterka et al. 2017).

Diagnostic species of the alliance Stygio–Caricion limosae: *Carex limosa*, *Drosera obovata*, *Gymnocolea inflata*, *Juncus stygius*, *Rhynchospora alba*, *Sphagnum platyphyllum*, *S. subsecundum*, *Utricularia minor*, *U. ochroleuca*, *Warnstorfia exannulata*, *W. fluitans*.

In the Numto Nature Park, communities of the alliance Stygio–Caricion limosae are represented by three associations with subassociations and variants, as well as one community type.

Utriculario ochroleucae–Caricetum limosae Lapshina et al. 2022 (Lapshina et al. 2022: 9–10, Table 1, rel. 1–26, Fig. 1).

The association encompasses small sedge-*Sphagnum*-liverwort communities in highly inundated, nutrient-poor quagmires and hollows of patterned meso-oligotrophic mires in the northern taiga zone of Western Siberia (Table 8, syntaxa 10–12; Fig. 2, clusters 7.1a, b, 7.2).

Diagnostic species: The diagnostic species combination for this association includes diagnostic species of the alliance: *Carex limosa*, *Drosera obovata*, *Juncus stygius*, *Sphagnum platyphyllum*, *Utricularia ochroleuca*, *Sphagnum compactum*, *Gymnocolea inflata*, as well as *Pedicularis karoi* and *Scapania paludicola*. The distribution of some of these species in the nature park is closely associated with communities of this particular association.

This association has been previously described by us in the southern part of the Numto Nature Park (Lapshina et al. 2022), where it is represented by two subassociations that differ in the species composition of the ground cover.

Utriculario ochroleucae–Caricetum limosae subass. typicum Lapshina et al. 2022 (Lapshina et al. 2022: 9–10, Table 1, rel. 1–16, Fig. 1)

In typical form, the subassociation does not have its own diagnostic species and is characterized by numerous diagnostic species of the association.

Structure and composition: The 15–20 cm high grass layer ((cover is 10–45 %) is formed by *Carex limosa* and *Menyanthes trifoliata*. In lesser abundance but with more or less consistency, *Eriophorum angustifolium*, *E. russeolum*, *Carex chordorrhiza*, and *Drosera anglica* are also encountered. If developed, the moss layer (5–90 %) is usually composed of liverworts such as *Gymnocolea inflata*, with the participation of *Cladopodiella fluitans* and *Scapania paludicola*, and a very slight admixture of mosses – *Sphagnum platyphyllum*, *S. compactum*, *S. subsecundum*, *Warnstorfia* spp. Only in the communities of this association is the extremely rare species *Sphagnum inexpectatum* observed, known not only from findings in the Numto Nature Park but also from just three other locations in the territory of Western Siberia (Lapshina et al. 2018, 2023a).

Distribution and ecology. The communities of this association are found within ridge-lake-mire complexes featuring

Table 4. Associations of the alliance Stygio–Caricion limosae. Sedge-moss-hepatic communities in waterlogged oligotrophic and meso-oligotrophic hollows. 1–11 – Utriculario ochroleuco–Caricetum limosae var. inops (1); 12–28 – Sphagno compacti–Caricetum limosae (2), 29–35 – Cladopodiello fluitantis– Trichophoretum cespitosae subass. sphagnetosum compacti (3).

Associations	*Utriculario ochroleuco–Caricetum limosae* var. *inops* (1)											*Sphagno compacti–Caricetum limosae* (2)																	(3)							Constancy and abundance		
Plant cover, %																																						
dwarf shrub	0	0	0	0	0	1	0	3	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	5	2	5	0			
herbs	10	15	30	25	10	35	15	35	15	15	15	20	35	20	30	40	20	20	10	10	20	15	30	40	35	30	30	40	30	50	80	40	50	35	30			
bryophytes	90	55	100	80	50	35	75	100	50	80	30	40	85	90	100	90	90	30	35	40	80	95	100	80	100	100	20	70	80	40	70	90	80	75	50			
Number of species	10	8	11	12	13	15	12	10	11	13	10	13	15	14	10	9	14	13	11	13	13	12	11	10	12	9	13	14	11	10	13	12	10	13	9			
Relevé nr. by author	088E22nu	010F22nu	009G22nu	011E22nu	009F22nu	078E22nu	054F22nu	059G22nu	056F22nu	080E22nu	056F22nu	051V22nu	074E22nu	023E22nu	057G22nu	052V22nu	312E17nu	415E17nu	023F17nu	024F17nu	086E22nu	096E22nu	063G22nu	320E17nu	321E17nu	071G22nu	046V22nu	040V22nu	077E22nu	045V22nu	315E17nu	336E17nu	062G22nu	059F22nu	414E17nu			
Relevé nr. in the table	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22***	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**1**	**2**	**3**
Diagnostic species of the Utriculario ochroleuco–Caricetum limosae var. inops																																						
Carex limosa	2a	2a	2a	1	1	2b	2a	2a	2a	2a	2b	1	1	2a	2a	1	1	1	1	1	+	2a	2b	2b	2b	2a	1	2a	·	·	·	+	·	·	·	V^{2a}	V^{1}	I
Gymnocolea inflata **S.-C.l.**	5	3	4	3	3	3	3	2a	2b	4	2a	·	·	·	·	·	1	·	·	+	·	·	·	·	·	·	+	·	·	·	·	·	·	·	1	V^{3}	I	I
Sphagnum platyphyllum **S.-C.l.**	·	·	·	+	·	+	+	·	+	2a	+	·	·	+	·	·	·	·	·	·	·	·	2a	·	·	·	1	+	·	·	·	·	·	·	·	III^{+}	II	·
Utricularia ochroleuca **S.-C.l.**	·	·	+	·	·	+	·	·	+	+	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	II	I	·
Diagnostic species of the Sphagno compacti–Caricetum limosae																																						
Cladopodiella fluitans	1	·	·	·	+	+	1	1	+	+	1	3	4	5	4	3	3	2b	3	3	4	5	3	3	5	3	3	2b	3	2b	1	2b	2a	2a	2b	IV^{1}	V^{3}	V^{2b}
Trichophorum cespitosum	+	·	+	·	+	·	·	·	·	·	·	·	1	·	·	·	1	·	+	+	+	+	·	+	+	·	·	·	3	3	4	3	3	3	2b	II	III	V^{3}
Diagnostic species of the Stygio–Caricion limosae																																						
Sphagnum compactum	1	1	2a	2b	2b	2a	2b	2b	1	+	·	2a	2b	1	2b	1	3	2a	+	1	2a	2a	2a	2b	2a	2a	1	3	3	3	3	2b	4	3	2b	V^{2a}	V^{2a}	V^{3}
Menyanthes trifoliata	·	1	+	1	+	2a	1	1	2a	1	·	1	+	+	1	·	2a	2a	+	·	+	+	+	+	+	·	+	1	·	·	r	·	·	·	1	V^{1}	V^{+}	II
Warnstorfia fluitans	+	·	1	+	+	·	1	1	1	+	+	1	·	+	1	1	+	1	+	+	1	+	+	·	·	2a	+	·	·	·	·	·	·	·	2a	IV^{+}	IV^{+}	I
Drosera obovata **S.-C.l.**	·	·	·	·	·	+	+	1	·	1	+	+	+	1	1	1	1	1	+	+	+	1	1	·	·	1	1	+	·	·	·	·	·	·	2a	III^{+}	V^{1}	I
Drosera anglica	·	1	1	1	+	·	·	·	·	·	·	·	·	·	·	·	+	+	·	+	·	·	·	+	1	·	1	·	·	·	·	·	·	·	·	II^{r}	II	·
Diagnostic species of the Scheuchzerion palustre																																						
Sphagnum majus	+	·	2a	1	+	1	+	·	1	+	2a	1	1	1	·	1	2a	+	·	·	1	1	2a	2b	1	2a	1	1	·	1	·	2b	·	·	+	V^{+}	V^{1}	III
Carex rotundata	+	·	1	2a	+	·	·	2a	·	·	·	+	2b	·	·	+	1	·	·	·	2b	+	·	·	+	·	·	·	+	·	r	·	1	+	·	III^{+}	III	III^{r}
Eriophorum russeolum	·	+	1	1	1	·	1	·	+	·	·	+	·	1	1	·	·	·	1	·	1	1	·	+	1	1	·	+	·	·	·	·	·	·	·	III^{+}	III^{+}	·
Sphagnum lindbergii	·	+	·	1	+	+	+	·	·	1	1	1	·	·	·	·	·	·	1	1	·	·	·	·	·	2b	1	·	·	·	2b	2b	·	·	·	IV^{+}	II	II
Scheuchzeria palustris	·	·	1	+	+	·	·	·	·	+	+	·	1	+	·	·	r	1	·	·	·	+	1	·	·	·	·	·	·	·	·	·	·	·	·	III^{+}	II	·
Sphagnum jensenii	·	·	·	·	·	1	+	1	·	·	·	1	·	+	1	·	·	·	·	·	·	·	·	·	·	·	·	1	1	·	·	1	·	1	·	II	II	III
Sphagnum papillosum	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	1	·	·	·	·	·	·	·	·	·	·	1	2a	·	2a	·	·	+	·	·	I	III
Sphagnum balticum	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1	·	·	·	·	·	·	·	·	·	·	1	·	·	·	·	·	·	·	2a	·	·	I	I
Diagnostic species of the Scheuchzerio–Caricetea nigrae																																						
Eriophorum angustifolium	+	+	·	·	·	·	·	·	·	+	+	·	·	+	·	+	·	+	+	+	·	·	·	+	+	·	+	·	+	1	+	·	+	1	·	III	III	IV^{+}
Andromeda polifolia	·	·	·	·	·	+	·	1	·	·	·	·	1	·	1	·	·	+	·	·	·	·	·	+	1	·	·	1	1	+	1	1	1	1	·	I	II	V^{1}
Oxycoccus palustris	+	·	·	·	·	·	·	·	·	·	·	1	·	+	·	·	·	·	·	+	+	+	+	·	·	·	·	+	·	·	r	+	1	+	+	I	III	IV^{+}
Carex rostrata	·	·	·	·	·	+	·	·	·	·	·	·	+	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	+	·	·	+	·	·	I	I	II
Other species																																						
Drosera rotundifolia	·	·	·	·	·	+	·	·	·	·	·	+	·	·	·	1	·	·	·	·	+	·	·	·	·	·	·	+	+	1	·	1	·	+	·	I	II	III^{+}
Mylia anomala	·	·	·	·	·	·	·	·	·	·	·	·	r	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1	·	·	·	2a	+	·	·	I	III
Polytrichum jensenii	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	+	·	·	·	·	·	·	I	I
Polytrichastrum longisetum	·	·	·	·	·	·	·	·	·	·	·	·	r	·	·	·	·	·	·	·	+	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	I	·
Carex chordorrhiza	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	r	r	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	I	·
Calypogeia sphagnicola	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	+	·	·	·	II
Warnstorfia exannulata	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	r	·	·	·	·	I	I

Note. Species found in 1 relevé: *Aneura pinguis* (6 +), *Betula nana* (13 +), *Cephalozia loitlesbergeri* (33 +), *Ceratodon purpureus* (31 r), *Odontoschisma elongatum* (32 +), *Oxycoccus microcarpus* (30 +), *Pedicularis karoi* (17 +), *Polytrichum strictum* (31 r), *Rhynchospora alba* (27 +), *Sphagnum teres* (31 +), *Utricularia minor* (18 +), *Warnstorfia trichophylla* (23 +).

GPS coordinates (WGS 84) (N, E) and **dates**. **1** – 63.63888, 70.79406, 17.08.2022; **2** – 63.59058, 70.60366, 12.08.2022; **3** – 63.59333, 70.60250, 12.08.2022; **4** – 63.59335, 70.60268, 12.08.2022; **5** – 63.59328, 70.60246, 12.08.2022; **6** – 63.65778, 70.70638, 16.08.2022; **7** – 63.65521, 70.69856, 16.08.2022; **8** – 63.65583, 70.70194, 16.08.2022; **9** – 63.65574, 70.70110, 16.08.2022;; **10** – 63.65901, 70.71100, 16.08.2022;; **11** – 63.;65755, 70.70664, 16.08.2022; **12** – 63.63667, 70.79139, 17.08.2022; **13** – 63.65577, 70.70062, 16.08.2022; **14** – 63.61194, 70.60583, 13.08.2022; **15** – 63.65528, 70.69889, 16.08.2022; **16** – 63.63861, 70.79389, 17.08.2022; **17** – 63.24910, 70.73029, 15.08.2017; **18** – 63.66376; 70.59757, 20.08.2017; **19** – 63.27112, 70.76880, 15.08.2017; **20** – 63.27112, 70.76880, 15.08.2017; **21** – 63.63670, 70.79140, 17.08.2022; **22** – 63.64905, 70.79807, 17.08.2022; **23** – 63.65750, 70.70639, 16.08.2022; **24** – 63.26970, 70.77312, 15.08.2017; **25** – 63.26970, 70.77312, 5.08.2017; **26** – 63.63556, 70.79222, 17.08.2022; **27** – 63.65750, 70.70639, 16.08.2022; **28** – 63.65901, 70.71100, 16.08.2022; **29** – 63.65705, 70.70462, 16.08.2022; **30** – 63.65694, 70.70444, 16.08.2022; **31** – 63.25508, 70.74980, 15.08.2017; **32** – 63.30842, 70.75395, 16.08.2017; **33** – 63.65722, 70.70417, 16.08.2022; **34** – 63.65740, 70.70392, 16.08.2022; **35** – 63.66335, 70.79685, 20.08.2017.

Authors: E.D. Lapshina – rel. 1, 4, 6, 10, 13–14, 17–18, 21–22, 24–25, 29, 31–32, 35; I.V. Filippov – rel. 2, 5, 7, 9, 11, 19–20, 34; G.N. Ganasevich – rel. 3, 8, 15, 23, 26, 33; E.L. Verevkina – rel. 12, 16, 27–28, 30.

Diagnostic species (next to the name of the taxon): **S.-C.l. – Stygio–Caricion limosae**. *(shaded) – nomenclatural type (holotype).

oligotrophic birch-pine-dwarf shrub-*Sphagnum* frozen ridges and various types of hollows. They occupy waterlogged hollows or form floating mats along the periphery of small lakes. Less frequently, they occur as expansive floating fens interspersed with open water sections. The mire water level is either near the surface or 1–3 cm above it.

The subassociation communities prevalent in the central part of the park are distinguished by a low diversity composition of species and are designated as a distinct variant inops.

The variant inops (Table 4, rel. 1–11; Table 8, syntaxon 11; Fig. 2, cluster 7.1b) is characterized by the absence of *Juncus stygius* and a noticeable reduction in the constancy of *Drosera obovata* and *Utricularia ochroleuca*, compared to typical communities.

Utriculario ochroleucae–Caricetum limosae warnstorfietosum exannulatae Lapshina et al. 2022 (Table 8, syntaxon 12; Fig. 2, cluster 7.2) is characterized by the prevalence of *Warnstorfia exannulata* in the moss layer.

Within the subassociation, two variants have been identified: typica and Carex livida (Lapshina et al. 2022: 9–10, Table 1, rel. 17–26).

The variant **typica** represents the typical communities of the subassociation.

The variant **Carex livida** differs by the consistent presence of the rare, Euro-Arctic species, *Carex livida*, within the herb layer in Western Siberia.

Community type ***Carex limosa–Warnstorfia exannulata*** (Lapshina et al., 2022: 11, Table 1, rel. 27–30) (Table 8, syntaxon 13; Fig. 2, cluster 8)

In terms of habitat ecology and dominant species in the grass and moss layers, this community type is similar to the association Utricularia ochroleucae–Caricetum limosae (subass. warnstorfietosum exannulatae). However, they differ from it in a continuous moss carpet of *Warnstorfia exannulata* and dissapearance of most diagnostic species of the alliance Stygio–Caricion limosae. Among the species of this alliance, only *Utricularia minor* and *U. ochroleuca* occur in small quantities and with low constancy (Lapshina et al. 2022: 9–10, Table 1, rel. 27–30).

These communities are not widely distributed in the mires of northern West Siberia (Lapshina et al. 2022). In the Numto Nature Park, they sporadically occur within extensive meso-oligotrophic mire complexes, featuring various types of sedge-dominated, *Menyanthes*-sedge-moss, and *Menyanthes*-sedge-liverwort fen vegetation.

Sphagno compacti–Caricetum limosae ass. nov. (Table 4, rel. 12–28; Table 8, syntaxon 14; Figs 4A, 2, cluster 9)

Holotypus: relevé 22 (author's 096E22nu) in Table 4, KhMAO, Beloyarsk District, Numto Nature Park, 17.08.2022, author E.D. Lapshina.

The association encompasses low sedge-*Menyanthes*-liverwort communities of waterlogged hollows and floating mats in the aapa and palsa mires of the boreal zone of Eurasia.

Diagnostic species: *Carex limosa*, *Cladopodiella fluitans* (dom.), *Drosera obovata*, *Sphagnum compactum*, *Trichophorum cespitosum*.

Structure and composition. The 10–20 cm high grass layer is dense or sparse (projected coverage ranging from 10 to 40 %). It consists of *Carex limosa* and *Menyanthes trifoliata*, with minor occurrences of *Carex rotundata* and *Eriophorum russeolum* (Fig. 4A). Occasional tufts of *Trichophorum caespitosum* can be found, while *Drosera obovata*, and less frequently, *D. anglica*, are scattered near the surface. Occasionally, *Andromeda polifolia* is present in small amounts among dwarf shrubs. The ground cover is dominated by liverwort *Cladopodiella fluitans*, and scattered stems or small patches of peat mosses, *Sphagnum jensenii*, *S. lindbergii*, *S. majus*, *S. papillosum*, are observed.

Distribution and ecology. The surface of these habitats is either flat or slightly hummocky with small depressions. The water level stands close to the surface or 1–2 cm above it. The small hummocks are formed by overlapping dead stems of sedges and patches of *Sphagnum* mosses, rising by 3–5 cm.

Note. This association is easily recognizable in its natural habitat, presenting the characteristic appearance of communities within the alliance Stygio–Caricion limosae. Previously, it was described as a variant Carex limosa of *Trichophorum cespitosum*-liverwort communities within the association Cladopodiello fluitantis–Trichophoretum cespitosi (Lapshina et al. 2022). It differs from that variant by having lower abundance of *Trichophorum cespitosum* and higher constancy and noticeable presence of *Carex limosa*, which is typical for *Trichophorum-Sphagnum*-liverwort communities in the central and southern parts of the northern taiga of Western Siberia.

Cladopodiello fluitantis–Trichophoretum cespitosi Smagin ex Lapshina in Lapshina et al. 2022

This association encompasses *Trichophorum*-liverwort communities within oligotrophic mire complexes in the northern forest zone and forest-tundra of the European part of Russia and Western Siberia.

The association was first described in the mires of the Murmansk and Arkhangelsk regions under the name Hepatico–Baeothryetum cespitosi (Smagin 2000), and has recently been validated (Lapshina et al. 2022). In the moderately continental climate of Western Siberia, the association is represented by a distinct subassociation known as sphagnetosum compacti.

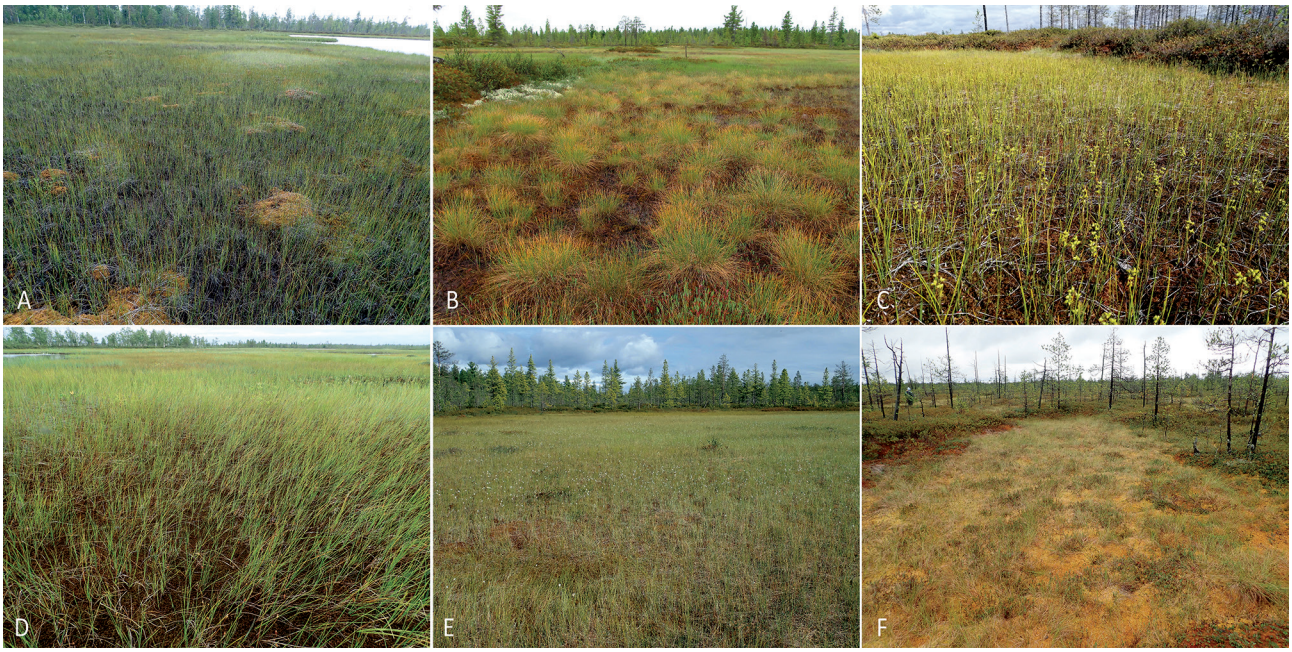

Figure 4 Photos of described mire communities in the Numto Nature Park. Alliances Stygio–Caricion limosae and Scheuchzetion palustris. A – Sphagno compacti–Caricetum limosae on floating mat along the lake edge within flat palsa-hollow mire complex; B –Cladopodiello fluitantis–Trichophoretum cespitosi sphagnetosum compacti near the edge of vast hollow in flat palsa-hollow complex; C – Scheuchzerio palustris–Sphagnetum jensenii in oligotrophic hollow of ridge-hollow complex; D – Carici limosae–Sphagnetum lindbergii eriophoretosum russeoli in the vast hollow of flat palsa-hollow complex; E – Carici rotundatae–Sphagnetum baltici in the vast hollows of palsa mire complex: subass. typicum (in the foreground), subass. eriophoretosum russeoli (in the background); F – Eriophoro vaginati–Sphagnetum baltici in an oligotrophic ridge-hollow complex

Table 5. Association Scheuchzerio palustris–Sphagnetum jensenii (1). Sedge-*Scheuchzeria*-peat moss communities of oligotrophic hollows dominated by *Sphagnum majus* and *S. jensenii*. 1–12 – subass. typicum (1a): 1–7 – var. typica, 8–12 - var. Sphagnum majus; 13–38 – subass. sphagnetosum majoris (1b): 13–30 – var. Sphagnum jensenii, 31–38 – var. typica.

Subassociation	typicum (1a)													sphagnetosum majoris (1b)																									Constancy and abundance		
Variant	typica							Sphagnum majus						Sphagnum jensenii															typica													
Plant cover, %																																									
herbs	10	15	10	10	10	10	25	20	25	10	15	15	10	20	10	15	15	15	5	20	20	25	25	15	20	20	10	20	10	10	20	20	20	25	10	20	15	20			
moss	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100			
Number of species	8	4	7	7	5	4	7	6	8	5	4	5	5	6	7	7	5	5	5	6	6	5	5	5	6	8	7	7	8	10	3	5	6	7	4	3	3	5			
Relevé nr. by author	354E17nu	054F17nu	018F22nu	061F17nu	062F17nu	080F17nu	020E22nu	006V22nu	007V22nu	020F22nu	109E06nu	019F22nu	062E22nu	034V22nu	114F17nu	021E22nu	050E22nu	035V22nu	049F22nu	048G22nu	049G22nu	084G22nu	027V22nu	064E22nu	083G22nu	412E17nu	369E17nu	019G22nu	047F22nu	308E17nu	050G22nu	052G22nu	377E17nu	018G22nu	069G22nu	105E06nu	438E17nu	070G22nu			
Relevé nr. in the table	1*	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34*	35	36	37	38			
Cluster	44	44	44	44	44	44	44	45	45	45	45	45	46	46	46	46	46	46	46	46	46	46	46	46	46	47	46	46	46	46	47	47	47	47	47	47	47	47	1a	1b	1
Diagnostic species of the ass. Scheuchzerio palustris-Sphagnetum jensenii																																									
Scheuchzeria palustris **S.p.**	2a	2a	2a	2a	1	·	3	2b	2b	2a	·	2a	2a	2b	·	2b	2b	·	1	2b	2b	2b	3	2b	2b	2b	2a	2b	1	+	2b	2b	2b	2b	·	·	·	·	V[2a]	IV[2b]	IV[2a]
Carex limosa **S.-C.**	+	+	+	+	1	1	+	·	1	·	1	·	·	·	2a	·	·	2a	+	+	+	1	2b	1	1	+	+	1	+	1	1	+	·	1	1	2b	2b	1	IV[+]	V[1]	IV[+]
Eriophorum russeolum **S.p.**	+	·	+	+	·	1	·	1	+	+	2b	+	·	1	1	+	+	1	+	1	1	1	·	+	·	+	+	1	+	1	·	+	+	1	1	1	+	2b	IV[+]	V[+]	V[+]
Sphagnum jensenii **S.p.**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**4**	**5**	**5**	**4**	**4**	3	3	2b	2b	2b	2b	2a	2a	2a	2a	1	1	1	1	2b	2a	2b	2b	·	·	·	·	·	·	·	·	V[5]	IV[2a]	IV[2b]
Diagnostic species of the subass. S.p.-S.j. sphagnetosum majoris																																									
Sphagnum majus **S.p.**	·	·	1	·	·	·	·	3	2a	2a	3	3	**4**	**4**	**4**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**4**	**4**	**4**	**4**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	III[+]	V[5]	V[5]
Diagnostic species of the Scheuchzerion palustris																																									
Sphagnum lindbergii	·	·	·	·	·	2a	·	·	1	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	2a	2b	2a	2a	·	·	·	·	·	·	·	1	I	I	I
Sphagnum balticum	+	·	1	1	·	·	2a	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	II	R	I
Diagnostic species of the Scheuchzerio-Caricetea																																									
Oxycoccus palustris	1	·	+	+	·	·	+	+	·	1	·	1	·	1	·	+	·	1	·	·	·	·	+	·	1	1	+	+	+	·	·	+	+	+	1	·	·	+	III[+]	III[+]	III[+]
Andromeda polifolia	1	·	·	·	·	·	·	·	·	·	·	·	·	·	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	1	·	·	·	·	·	·	·	·	I	I	I
Eriophorum angustifolium	·	·	·	·	+	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	I	R	I
Menyanthes trifoliata	·	1	·	1	·	·	·	·	·	·	·	·	1	1	·	·	·	·	·	+	+	·	·	·	·	+	·	·	1	+	·	·	+	·	·	·	·	·	I	II	II
Other species																																									
Drosera rotundifolia	+	·	·	·	·	·	·	+	+	·	·	·	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	II	I	I
Warnstorfia fluitans	·	·	·	·	·	·	+	·	1	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	1	·	·	·	·	I	I	I
Sphagnum riparium	·	·	·	·	1	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	I	R	I

Note. Species found in 1 relevé: *Carex rostrata* (25 +), *C. rotundata* (15 +), *Chamaedaphne calyculata* (17 r), *Cladopodiella fluitans* (34 +), *Oxycoccus microcarpus* (23 1), *Sphagnum papillosum* (15 1).

GPS coordinates (WGS 84) (N, E) and **dates**. **1** – 63.52897, 70.63895, 17.08.2017; **2** – 63.50179, 70.59700, 17.08.2017; **3** – 63.61083, 70.60620, 13.08.2022; **4** – 63.71466, 70.63907, 18.08.2017; **5** – 63.71466, 70.63907, 18.08.2017; **6** – 63.41616, 70.80244, 19.08.2017; **7** – 63.61056, 70.60556, 13.08.2022; **8** – 63.61111, 70.50611, 13.08.2022; **9** – 63.61111, 70.50611, 13.08.2022; **10** – 63.61214, 70.60726, 13.08.2022; **11** – 63.65612, 70.88565, 20.07.2006; **12 –** 63.61083, 70.60620, 13.08.2022; **13** – 63.67352, 70.56906, 15.08.2022; **14** – 63.67333, 70.56861, 15.08.2022; **15** – 63.45066; 70.70640; 21.08.2017; **16** – 63.61111, 70.60639, 13.08.2022; **17** – 63.55515, 70.57365, 14.08.2022; **18** – 63.67778, 70.56222, 15.08.2022; **19** – 63.67382, 70.56834, 15.08.2022; **20** – 63.67333, 70.56833, 15.08.2022; **21** – 63.67361, 70.56833, 15.08.2022; **22** – 63.64972, 70.79694, 17.08.2022; **23** – 63.65528, 70.57333, 14.08.2022; **24** – 63.67785, 70.56190, 15.08.2022; **25** – 63.64944, 70.79750, 17.08.2022; **26** – 63.66335, 70.79685, 20.08.2017; **27** – 63.50090, 70.59807, 17.08.2017; **28** – 66.61111, 70.60722, 13.08.2022; **29** – 63.67382, 70.56834, 15.08.2022; **30** – 63.24227, 70.69274, 15.08.2017; **31** – 63.67778, 70.56139, 15.08.2022; **32** – 63.67833, 70.56250, 15.08.2022; **33** – 63.71418, 70.64020, 18.08.2017; **34** – 63.61083, 70.60611, 13.08.2022; **35** – 63.63528, 70.79389, 17.08.2022; **36** – 63.65757, 70.88530, 20.07.2006; **37** – 63.45109, 70.70486, 21.08.2017; **38** – 63.63583, 70.79389, 17.08.2022.

Authors: E.D. Lapshina – rel. 1, 7, 11, 13, 16–17, 24, 26, 29, 31, 33, 36–37; I.V. Filippov – rel. 2–6, 10, 12, 19, 28; G.N. Ganasevich – rel. 20–22, 25, 27, 30, 32, 34–35, 38; E.L. Verevkina – rel. 8–9, 14, 18, 23.

Diagnostic species (next to the name of the taxon): **S.-C. – Scheuchzerio–Caricetea nigrae, S. p. – Scheuchzerion palustris**. *(shaded) – nomenclatural type (holotype).

Cladopodiello fluitantis–Trichophoretum cespitosi sphagnetosum compacti Lapshina et al. 2022 (Table 4, rel. 29–35; Table 8, syntaxon 15; Figs 4B, 2, cluster 10)

Diagnostic species: *Cladopodiella fluitans* (dom.), *Sphagnum compactum*, *Trichophorum caespitosum*.

Structure and composition. In the communities the total cover of the dwarf shrub-grass layer varies between 30 and 80 %. The 10–20 cm high grass layer is dominated by *Trichophorum caespitosum* (20–60 %) Fig. 4B). As a minor component, there are also *Carex limosa* and *C. rotundata*, *Eriophorum russeolum*, *E. angustifolium*, and *Drosera rotundifolia*. Among dwarf shrubs, there are occurrences of *Andromeda polifolia* and *Oxycoccus palustris*, and occasionally individual plants of *Betula nana*. The ground cover is primarily dominated by *Cladopodiella fluitans* with patches of peat mosses, with *Sphagnum compactum* being the most abundant, followed by *S. lindbergii*, *S. majus*, and *S. jensenii*, although these are less frequent and occur in smaller quantities.

Distribution and ecology. The surface is finely hummocky, formed by dense tussocks of *Trichophorum caespitosum*, reaching a height of 3–5 cm. Water level is at the surface between these tussocks. Within the Numto Nature Park, communities of this subassociation sporadically occur. They occupy small patches along the periphery of vast hollows within ridge-hollow and ridge-palsa-lake-hollow mire complexes.

Note. In comparison to the communities of the subassociation typicum described in the northern European part of Russia, the West Siberian communities differ by the high constancy and abundance of *Sphagnum compactum*, the absence of European species like *Sphagnum tenellum* and *S. rubellum*, and typically boreal species like *Eriophorum vaginatum* and *Rhynchospora alba*, which are common in the milder and more humid climate of northern Europe (Lapshina et al. 2022). Additionally, in small quantities, hypoarctic species like *Carex rotundata* and *Eriophorum russeolum* appear.

Ombrotrophic *Sphagnum* bog-hollow vegetation

The low-sedge-*Sphagnum* communities of waterlogged hollows are classified within the order Scheuchzerietalia palustris Nordhagen 1936 ex Tx. 1937 and the alliance

Scheuchzetion palustris Nordhagen ex Tx. 1937.

The Scheuchzerietalia palustris encompasses ombrotrophic and oligotrophic communities of hollows and floating *Sphagnum* lawns with high water levels in raised mire complexes on deep peat.

Alliance **Scheuchzetion palustris**

The alliance combines the ombrotrophic hollows vegetation of *Sphagnum* lawns with atmospheric nutrient supply and highly acidic substrate reaction on raised bogs in Eurasia.

In the modern classification system of the European mire vegetation, this order includes exclusively ombrotrophic vegetation of *Sphagnum* hollows in the Eurasian raised bogs and comprises only one alliance, Scheuchzerion palustris (Mucina et al. 2016).

Diagnostic species of the alliance: *Carex limosa*, *Eriophorum russeolum*, *Rhynchospora alba*, *Scheuchzeria palustris*, *Sphagnum balticum*, *S. cuspidatum*, *S. jensenii*, *S. lindbergii*, *S. majus*, *S. papillosum*, *Cladopodiella fluitans*, *Calypogeia sphagnicola*.

A characteristic feature of the communities within the alliance Scheuchzerion palustris in the moderately continental climate of Western Siberia is the constant presence, albeit in low abundance, of species from the class Oxycocco-Sphagnetea.

Within the Numto Nature Park, the alliance is represented by four associations, five subassociations, seven variants, and one community type.

Scheuchzerio palustris–Sphagnetum jensenii ass. nov. (Table 5, rel. 1–38; Table 8, syntaxa 16, 17; Figs 4C, 2, clusters 11.1, 11.2)

Holotypus: relevé 1 (author's number 354E17nu) in Table 5, KhMAO, Beloyarsk District, Numto Nature Park, 17.08.2017, author E.D. Lapshina.

The association includes sedge-*Scheuchzeria*-peat moss communities dominated by *Sphagnum jensenii* and *S. majus* in the moss cover in the waterlogged hollows of raised bogs in the continental regions of the boreal zone of Eurasia.

This association was provisionally described based on relatively limited data in oligotrophic peat moss hollows at the northern edge of its distribution in Western Siberia (Lapshina et al. 2022).

Diagnostic species: *Carex limosa*, *Eriophorum russeolum*, *Scheuchzeria palustris*, *Sphagnum jensenii* (dom.), *S. majus*.

Synonyms and similar syntaxa: *Carex limosa-Sphagnum dusenii*, *Scheuchzeria palustris-Sphagnum dusenii* (Bogdanowskaya-Guihéneuf 1928), *Scheuchzeria-Sphagnum jensenii*, *Scheuchzeria-Sphagnum majus* (Boch & Vasilevich 1980), *Scheuchzeria-Shagnum dusenii* (Abramova 1951), Caricetum limosae sphagnetosum jensenii, Caricetum limosae sphagnetosum majii [recte: sphagenosum majoris] (Boch & Smagin 1993, Smagin 1999a).

Structure and composition: The grass layer is 20–25 cm high, appearing either sparse or dense (covering 5–40 %, commonly 10–20 %), composed of *Carex limosa*, *Eriophorum russeolum*, and *Scheuchzeria palustris*, the latter often dominating (Fig. 4C). Scattered dwarf shrubs include *Andromeda polifolia* and *Oxycoccus palustris*. The continuous moss cover is predominantly a mixture of two species, *Sphagnum jensenii* and *S. majus*, with each potentially being dominant. Occasionally, slight contributions might come from *S. balticum* and *S. lindbergii*.

Ecology and distribution: These communities occupy waterlogged oligotrophic hollows of raised bog complexes. The mire water level typically remains at the surface of the moss layer or 1–2 cm below it, occasionally decreasing to 5–8 cm during extremely dry periods of the growing season.

In Scandinavia, the Baltic region, and the northern part of European Russia, these communities are primarily limited to the northern taiga subzone. In Western Siberia, their distribution covers a broader area, extending into the middle taiga subzone. Within the territory of the Numto Nature Park, this association is one of the most widely spread within the alliance Scheuchzerion palustris.

Based on the participation of various species of *Sphagnum* mosses in the composition of the moss layer, two subassociations have been identified: typicum and sphagnetosum majoris. These subassociations are distinguished by the dominance of corresponding *Sphagnum* moss species, *Sphagnum jensenii* and *S. majus*, respectively.

Scheuchzerio palustris–Sphagnetum jensenii typicum subass. nov. (Table 5, rel. 1–12; Table 8, syntaxon 16; Fig. 2, cluster 11.1)

Holotypus: relevé 1 (author's number 354E17nu) in Table 5, KhMAO, Belyarsk District, Numto Nature Park, 17.08.2017, author E.D. Lapshina.

Diagnostic species: same as the association.

Structure and habitats: The grass layer is same as in the association. The moss layer differs due to the dominance of *Sphagnum jensenii*, often accompanied by *Sphagnum majus*. Among other species of *Sphagnum* mosses, there are occasional mixtures of *Sphagnum balticum* and *S. lindbergii*.

Ecology and distribution. Same as the association.

Based on the composition of the moss layer, within the subassociation, two variants have been identified: the variant typica dominated by *Sphagnum jensenii* in the moss cover (Table 5, rel. 1–7) and the variant Sphagnum majus, which is distinguished by a consistently noticeable admixture (up to 30–40 %) of this species (Table 8, rel. 8–12).

Scheuchzerio palustris–Sphagnetum jensenii sphagnetosum majoris subass. nov. (Table 5, rel. 13–38, Table 8, syntaxon 17; Fig. 2, cluster 11.2)

Holotypus: relevé 34 (author's number 018G22nu) in Table 5, KhMAO, Belyarsk District, Numto Nature Park, 13.08.2022, author G.N. Ganasevich.

Diagnostic species: *Sphagnum majus* (dom.).

Synonyms and similar syntaxa: *Carex limosa-Sphagnum dusenii*, *Scheuchzeria palustris-Sphagnum dusenii* (Bogdanowskaya-Guiheneuf 1928), *Scheuchzeria-Sphagnum majus* (Boch & Vasilevich 1980), *Scheuchzeria-Sphagnum dusenii* (Abramova 1951), Caricetum limosae sphagnetosum majii [recte: sphagenosum majoris] (Boch & Smagin 1993, Smagin 1999a); *Scheuchzeria palustris–Sphagnum majus* (Kuznetsov 2005).

Structure and habitats. The ground cover is formed by a continuous carpet of *Sphagnum majus* or with a noticeable admixture (up to 25 %) of *S. jensenii*, less frequently *S. lindbergii*.

This subassociation is more widely distributed across the mires of the nature park, occupying the lowest levels of oligotrophic bog hollows. The water level of the bog hollows stands at the surface.

Based on the species composition of the moss layer, two variants have been identified. The variant Sphagnum jensenii (Table 5, rel. 13–30) is distinguished by a more or less noticeable admixture of *Sphagnum jensenii*. The variant typica (Table 5, rel. 31–38) is characterized by a monodominant carpet of *Sphagnum majus*, with no or extremely insignificant presence of other species.

Carici rotundatae–Sphagnetum lindbergii Nordhagen ex Lapshina et al. 2022 (Table 6, rel. 1–14; Table 8, syntaxa 18, 19; Fig. 2, clusters 12.1, 12.2)

The association has recently been validated based on descriptions from northern Norway (Nordhagen 1928), and in the narrower syntaxonomical meaning, it exclusively encompasses oligotrophic communities of *Carex rotundata* and *Eriophorum russeolum* dominated by *Sphagnum lindbergii* in the moss layer (Lapshina et al. 2022).

Diagnostic species: *Carex rotundata*, *Eriophorum russeolum*, *Sphagnum lindbergii* (dom.).

Structure and composition: The grass layer, ranging from 15 to 20 cm in height, consists of *Carex rotundata* and *Eriophorum russeolum* in varying proportions. The total grass cover ranges from 10 to 20 %. Occasional dwarf shrubs include *Andromeda polifolia* and *Oxycoccus palustris*. A distinct feature of this association is the continuous moss layer dominated by

Table 6. Associations of the alliance Scheuchzerion palustre. Sedge-cotton grass-peat moss communities of oligotrophic hollows dominated by *Sphagnum lindbergii*. 1–14 – Carici rotundatae–Sphagnetum lindbergii (1): 1–7 – subass. typicum (1a), 9–14 – subass. eriophoretosum russeoli (1b); 15–26 – Carici limosae–Sphagnetum lindbergii subass. eriophoretosum russeoli (2).

Association	Carici rotundatae–Sphagnetum lindbergii (1)														Carici limosae–Sphagnetum lindbergii (2)										Constancy and abundance			
Subassociation	typicum (1a)								(1b)						eriophoretosum russeoli													
Plant cover, %																												
dwarf shrubs	0	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0				
herbs	10	15	10	15	20	20	20	10	10	15	15	10	20	20	20	7	5	15	20	20	15	25	25	255	10	10				
bryophyts	100	100	100	100	100	100	100	65	95	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100				
Number of species	5	8	10	7	8	11	9	7	8	7	7	6	4	3	5	4	6	5	7	9	7	4	5	8	6	6				
Relevé nr. by author	126F06nu	088E06nu	160E06nu	018F06nu	119E06nu	421E17nu	150E06nu	015F06nu	101F17nu	156E06nu	012F06nu	054E06nu	327E17nu	012F22nu	012E22nu	407E17nu	055F17nu	323E17nu	010G22nu	116E06nu	406E17nu	012G22nu	014E22nu	068G22nu	052E22nu	106E06nu				
Relevé nr. in the table	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18*	19	20	21	22	23	24	25	26	1a	1b	1	2
Diagnostic species of the ass. Carici rotundatae–Sphagnetum lindbergii																														
Sphagnum lindbergii	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**2b**	**4**	**5**	**5**	**5**	**4**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**V⁵**	**V⁵**	**V⁵**	**V⁵**
Carex rotundata	2a	2a	2a	2a	2b	2b	2b	2a	·	+	·	+	+	·	·	·	·	·	·	+	·	·	·	·	·	·	**V²ᵃ**	**III^r**	**IV²ᵃ**	**I**
Eriophorum russeolum	·	+	+	+	+	+	+	·	2a	2a	2b	2a	2b	2b	1	2a	+	1	1	1	2a	3	3	3	·	·	**IV⁺**	**V²ᵃ**	**V⁺**	**V¹**
Diagnostic species of the ass. Carici limosae–Sphagnetum lindbergii																														
Carex limosa	·	1	+	·	·	·	·	·	·	·	+	·	·	·	2b	1	+	2a	2b	2b	1	1	1	1	+	2a	**II**	**I**	**II**	**V¹**
Diagnostic species of the com. type *Eriophorum russeolum–Warnstorfia fluitans*																														
Warnstorfia fluitans	·	·	·	·	·	·	·	+	·	·	+	+	·	·	·	·	·	+	·	+	·	·	·	·	·	+	**I**	**II**	**II**	**II**
Diagnostic species of the Scheuchzerion palustris																														
Sphagnum balticum	·	·	2a	2b	2b	2a	2a	2b	·	+	·	2b	2b	2b	·	·	·	·	·	·	1	2a	2b	1	1	2a	**IV²ᵃ**	**IV²ᵃ**	**IV²ᵃ**	**III⁺**
Sphagnum jensenii	·	·	·	·	·	+	2a	2b	2b	·	1	·	·	·	·	·	1	1	1	2a	·	·	·	1	2a	·	**II**	**II**	**II**	**III⁺**
Sphagnum majus	·	2a	1	·	·	1	·	·	·	·	·	1	·	·	·	·	·	·	·	·	·	·	·	1	1	2a	**II**	**I**	**II**	**II**
Scheuchzeria palustris	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	1	·	·	·	·	**I**
Diagnostic species of the Scheuchzerio–Caricetea nigrae																														
Oxycoccus palustris	·	1	1	2a	+	+	1	·	+	1	+	·	+	·	+	+	·	·	·	·	1	·	+	+	·	·	**IV⁺**	**IV⁺**	**IV⁺**	**III**
Andromeda polifolia	+	+	+	+	+	+	1	+	+	·	·	r	·	·	·	·	·	·	1	+	+	·	·	·	·	+	**V⁺**	**II**	**IV⁺**	**II**
Eriophorum angustifolium	+	·	·	·	+	+	+	·	+	+	·	·	·	·	+	·	·	·	+	·	·	·	·	·	·	·	**III^r**	**II**	**III**	**I**
Menyanthes trifoliata	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	1	·	·	·	·	·	·	·	·	**I**	**I**	**I**
Other species																														
Drosera anglica	+	·	+	·	+	·	+	·	·	+	·	·	·	·	·	·	+	·	·	+	·	·	·	+	·	·	**III^r**	**I**	**II**	**II**
Drosera rotundifolia	·	·	·	+	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	+	+	·	·	·	·	·	**II**	·	**I**	**I**
Cladopodiella fluitans	·	·	·	·	·	·	·	1	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	**I**	**I**	**I**	·
Sphagnum papillosum	·	·	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	**II**	·	**I**	·
Chamaedaphne calyculata	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	**I**	**I**	·

Note. Species found in 1 relevé: *Sphagnum divinum* (2 +), *Straminergon stramineum* (9 1).

GPS coordinates (WGS 84) (N, E) and **dates**. **1** – 63.66257, 70.91842, 22.07.2006; **2** – 63.65239, 70.86367, 20.07.2006; **3** – 63.69907, 70.93349, 23.07.2006; **4** – 63.67107, 70.86288, 19.07.2006; **5** – 63.66322, 70.91821, 22.07.2006; **6** – 63.65865, 70.63459, 20.08.2017; **7** – 63.66322, 70.91821, 22.07.2006; **8** – 63.66515, 70.90028, 18.07.2006; **9** – 63.65996, 70.61956, 20.10.2017; **10** – 63.67374, 70.91981, 23.07.2006; **11** – 63.66454, 70.89904, 18.07.2006; **12** – 63.67812, 70.86625, 19.07.2006; **13** – 63.29221, 70.80423, 16.08.2017; **14** – 63.58720, 70.60259, 12.08.2022; **15** – 63.59077, 70.60344, 12.08.2022; **16** – 63.66967, 70.40706, 20.08.2017; **17** – 63.50179, 70.59700, 17.08.2017; **18** – 63.29300, 70.80117, 16.08.2017; **19** – 63.59083, 70.60361, 12.08.2022; **20** – 63.65568, 70.93169, 22.07.2006; **21** – 63.66967, 70.40706, 20.08.2017; **22** – 63.58722, 70.60250, 12.08.2022; **23** – 63.58747, 70.60277, 12.08.2022; **24** – 63.63528, 70.79389, 17.08.2022; **25** – 63.55515, 70.57365, 14.08.2022; **26** – 63.65757, 70.88530, 20.07.2006; **27** – 63.65367, 70.89560, 22.07.2006; **28** – 63.68063, 70.87115, 19.07.2006; **29** – 63.65757, 70.88530, 20.07.2006; **30** – 63.67812, 70.86625, 19.07.2006.

Authors: E.D. Lapshina – rel. 2–3, 5–7, 10, 12–13, 15–16, 18, 20–21, 23, 25–26, 29–30; I.V. Filippov – rel. 1, 4, 8–9, 11, 14, 17, 28; G.N. Ganasevich – rel. 19, 22, 24; N.V. Filippova – rel. 27. *(shaded) – nomenclatural type (holotype).

Sphagnum lindbergii. Sometimes, there is a noticeable admixture of *S. balticum*, *S. jensenii*, and *S. majus*. Other grass and moss species are rare and less abundant.

Distribution and ecology. Communities of this association are found in waterlogged hollows and floating *Spagnum* lawns within flat palsa mires and palsa-lake-hollow mire complexes. The water level usually stands either at the surface of the moss layer or 1–3 cm below it. In the territory of the nature park, these communities are rare.

Within the association, two subassociations are distinguished: typicum and eriophoretosum russeoli.

Carici rotundatae–Sphagnetum lindbergii typicum (Table 6, rel. 1–8; Table 8, syntaxon 18; Fig. 2, cluster 12.1)

Diagnostic species: *Carex rotundata* (dom.), *Sphagnum lindbergii* (dom.).

Structure and composition: The communities of this subassociation are characterized by a grass layer dominated by *Carex rotundata* (cover 5–25 %) and a continuous moss cover composed of *Sphagnum lindbergii*. *Eriophorum russeolum* accompanies the sedges with high constancy but low abundance, while scattered patches of *Andromeda polifolia* can be found. In some communities, *S. balticum* contributes a noticeable portion to the moss cover alongside *S. lindbergii*. Other species are rare and not abundant.

Based on the composition of the moss cover, two variants are identified within this subassociation: typica and Sphagnum balticum. In communities of the variant typica, the moss cover is monodominant, primarily consisting of *Sphagnum lindbergii*. The Sphagnum balticum variant is more common and is characterized by a more noticeable admixture of *Sphagnum balticum*, occasionally also *S. jensenii* and *S. majus*, in the moss cover (Lapshina et al. 2022).

Carici rotundatae–Sphagnetum lindbergii eriophoretosum russeoli Lapshina et al. 2022 (Table 6, rel. 9–14; Table 8, syntaxon 19; Fig. 2, cluster 12.2)

The subassociation combines low-diversity communities characterized by the predominance of *Eriophorum russeolum* and *Sphagnum lindbergii*.

Diagnostic species: *Eriophorum russeolum* (dom.), *Sphagnum lindbergii* (dom.).

Structure and composition. The sparse grass layer is domi-

Table 7. Associations of the alliance Scheuchzerion palustris. Sedge-cotton grass-peat moss communities of oligotrophic hollows dominated by *Sphagnum balticum*. 1–12 – Eriophoro vaginati–Sphagnetum baltici (1); 13–40 – Carici rotundatae–Sphagnetum baltici (2): 13–23 – subass. typicum (2a), 24–40 – subass. eriophoretosum russeoli (2b).

Associations	**Eriophoro vaginati–Sphagnetum baltici (1)**												**Carici rotundatae–Sphagnetum baltici (2)**																												**Constancy and abundance**			
Subassociation	–												**typicum (2a)**											**eriophoretosum russeoli (2b)**																				
Plant cover, %																																												
dwarf shrubs	0	5	0	5	5	2	0	3	5	1	15	15	20	5	0	5	0	0	0	20	0	0	0	0	5	5	5	0	0	0	0	5	5	5	0	30	0	0	0	0				
herbs	30	15	25	20	20	20	35	30	20	20	20	10	35	20	15	15	20	20	15	20	30	20	20	20	10	20	20	25	20	5	20	20	25	20	20	3	3	35	15	20				
mosses	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	90	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	0	100	100				
Number of species	3	7	8	7	4	6	3	7	6	11	12	7	7	6	7	15	5	12	8	9	10	7	7	8	4	4	3	6	4	6	4	6	6	10	5	12	9	5	5	8				
Relevé nr. by author	057F17nu	011E11nu	015E22nu	013F22nu	014F22nu	013G22nu	001V22nu	002V22nu	014G22nu	371E17nu	016E22nu	065F06nu	437E17nu	101E22nu	104E22nu	051E06nu	091G22nu	152E06nu	153E06nu	337E17nu	318E17nu	116F17nu	087E22nu	106E22nu	026F22nu	036G22nu	028G22nu	066V22nu	330E17nu	108E06nu	021G22nu	034E22nu	035E22nu	047E22nu	090G22nu	324E17nu	085E22nu	009V22nu	328E17nu	004E06nu				
Relevé nr. in the table	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**1**	**2a**	**2b**	**2**
Diagnostic species of the ass. Eriophoro vaginati–Sphagnetum baltici																																												
Sphagnum balticum **S.p.**	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	4	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	V^{5}	V^{5}	V^{5}	V^{5}
Eriophorum vaginatum	3	2b	2b	2b	2b	2b	3	3	2b	2b	2b	2a	·	·	·	r	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	V^{2b}	I	·	R
Diagnostic species of the ass. Carici rotundatae–Sphagnetum baltici																																												
Carex rotundata **S.p.**	·	·	·	·	·	·	·	·	·	1	·	·	3	2b	2b	2a	2b	2b	2a	2b	3	2b	2b	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	I	V^{2b}	I	III
Eriophorum russeolum **S.p.**	·	·	·	·	·	·	·	·	·	·	·	+	2a	+	·	+	+	·	·	1	+	·	1	2b	2a	2b	2b	2b	2a	1	2b	2b	2b	2a	2b	1	1	2b	2b	1	I	IV^{+}	V^{2b}	V^{2a}
Diagnostic species of the Scheuchzerion palustris																																												
Sphagnum lindbergii	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	2b	2b	2b	1	·	·	·	·	·	·	·	·	1	·	·	·	·	1	1	1	2a	2b	2b	I	II	III	II
Sphagnum majus	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1	2a	2a	1	2b	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	I	III	·	I
Sphagnum jensenii	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	2a	2b	1	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	II	I	I
Scheuchzeria palustris	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	I	R
Diagnostic species of the Oxycocco–Sphagnetea																																												
Drosera rotundifolia	·	·	·	·	·	·	·	+	·	·	+	+	·	·	+	+	·	+	·	+	·	·	·	+	·	·	·	+	·	·	·	·	+	1	·	+	·	·	·	·	II	II	II	II
Chamaedaphne calyculata	·	1	+	·	·	·	·	·	·	r	+	2a	·	·	·	+	·	+	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	III	I	I	I
Oxycoccus microcarpus	+	·	·	·	·	·	·	1	·	1	+	·	+	·	·	1	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	+	·	·	·	II	I	I	I
Sphagnum divinum	·	+	+	·	·	·	·	1	·	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	III	·	·	·
Mylia anomala	·	+	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	r	+	·	·	·	I	·	I	I
Rubus chamaemorus	·	·	+	·	·	·	·	·	·	r	+	·	·	·	·	+	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	II	I	·	I
Calypogeia sphagnicola	·	·	·	·	·	·	·	·	·	·	·	·	r	·	·	r	·	·	·	1	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	r	+	·	·	·	·	II	I	II
Diagnostic species of the Scheuchzerio–Caricetea nigrae																																												
Oxycoccus palustris	·	1	1	1	1	2a	1	1	1	+	1	+	+	+	1	1	+	+	+	1	1	+	+	+	1	+	1	1	2b	+	1	1	2b	2b	+	+	·	2b	·	2b	V^{1}	V^{+}	V^{1}	V^{+}
Andromeda polifolia	·	1	r	1	1	1	·	1	1	·	2a	+	1	1	1	1	·	+	·	2a	·	+	+	+	·	·	·	·	·	·	·	1	+	+	·	2b	·	·	r	r	IV^{1}	IV^{+}	III	III^{r}
Carex limosa	·	·	·	·	·	1	·	·	1	·	+	·	·	·	+	1	1	+	1	·	·	+	·	1	·	·	·	1	·	1	1	·	·	·	1	·	1	+	·	+	II	III^{+}	III	III^{r}
Eriophorum angustifolium	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	r	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	r	·	I	I	I
Warnstorfia fluitans	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	1	·	·	·	·	·	·	·	·	·	·	·	·	+	+	·	·	·	·	·	·	·	·	I	I	I
Other species																																												
Cladopodiella fluitans	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	+	·	r	1	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	II	I	I
Straminergon stramineum	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	r	·	·	·	·	·	I	I
Drosera anglica	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	+	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	r	·	I	I	I
Carex pauciflora	·	·	+	1	·	1	·	·	1	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	II	·	·	·
Heterogemma laxa	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	I	I	I	I
Drosera obovata	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1	+	·	r	·	·	·	I	I

Note. Species found in 1 relevé with abundance indicated in brackets: *Betula nana* (10 +), *Carex rostrata* (21 +), *Cephaloziella spinigera* (34 +, 36 r), *Menyanthes trifoliata* (21 +), *Sphagnum fuscum* (11 +), *S. riparium* (32 +), *S. russowii* (10 1).

GPS coordinates (WGS 84) (N, E) and **dates**. **1** – 63.47554, 70.68029, 17.08.2017; **2** – 63.66294, 66.76827, 16.08.2011; **3** – 63.60430, 70.61960, 13.08.2022; **4** – 63.60454, 70.61901, 13.08.2022; **5** – 63.60546, 70.61775; 13.08.2022; **6** – 63.60444, 70.61917, 13.08.2022; **7** – 63.60417, 70.61972, 13.08.2022; **8** – 63.60500, 70.61805, 13. 08.2022; **9** – 63.60556, 70.61806, 13.08.2022; **10** – 63.4749, 70.68088, 17.08.2017; **11** – 63.60500, 70.62778, 13.08.2022; **12** – 63.62763, 70.89691, 20.07.2006; **13** – 63.44933, 70.70512, 21.08.2017; **14** – 63.58110, 70.75951, 18.08.2022; **15** – 63.57662, 70.77462, 18.08.2022; **16** – 63.67643, 70.85776, 19.07.2006; **17** – 63.58417, 70.75389, 18.08.2022; **18** – 63.67297, 70.91687, 23.07.2006; **19** – 63.67297, 70.91687, 23.07.2006; **20** – 63.30812, 70.75513, 16.08.2017; **21** – 63.27060, 70.77357, 15.08.2017; **22** – 63.44995, 70.70643, 21.08.2017; **23** – 63.63863, 70.79285, 17.08.2022; **24** – 63.58333, 70.75352, 18.08.2022; **25** – 63.61458, 70.62543, 13.08.2022; **26** – 63.65139, 70.57972, 14.08.2022; **27** – 63.61472, 70.62556; 13.08.2022; **28** – 63.58333, 71.58639, 18.08.2022; **29** – 63.30725, 70.70712, 16.08.2017; **30** – 63.65612, 70.88565, 20.07.2006; **31** – 63.61250; 70.60750; 13.08.2022; **32** – 63.61556, 70.62028, 13.08.2022; **33** – 63.61444, 70.62500, 13.08.2022; **34** – 63.65159, 70.57932, 14.08.2022; **35** – 63.58361, 70.75306, 18.08.2022; **36** – 63.29300, 70.80117, 16.08.2017; **37** – 63.63502, 70.79555, 17.08.2022; **38** – 63.61444, 70.62500, 13.08.2022; **39** – 63.29276, 70.80412, 16.08.2017; **40** – 63.66431, 70.89867, 18.07. 2006.

Authors: E.D. Lapshina – rel. 2–3,10–11, 13–16, 18–21, 23–24, 29–30, 32–34, 36–37, 39–40; I.V. Filippov – rel. 1,4–5, 22, 25; G.N. Ganasevich – rel. 6, 9, 17, 2, 27, 31, 35; E.L. Verevkina – rel. 7–8, 28, 38.

Diagnostic species (next to the name of the taxon): **S.p. – Scheuchzerion palustris**.

nated by *Eriophorum russeolum* (10–20 %), with a minor presence of *Carex rotundata*. In the continuous moss cover of *Sphagnum lindbergii*, there is occasionally a slight admixture of *S. balticum*. The water level in the habitats is at the level of the heads of the *Sphagnum* mosses.

Based on the structure of the moss cover, two variants are distinguished within the subassociation. The variant typica features a monodominant moss cover of *Sphagnum lindbergii*, while the variant Sphagnum balticum is characterized by a consistent and somewhat noticeable presence of *Sphagnum balticum* (Lapshina et al. 2022).

Carici limosae–Sphagnetum lindbergii Rudolph et al. 1928.

Lectopypus. The nomenclatural type of the association should be recognised the relevé by Rudolph et al. (1928), published in the synoptic table (Rudolph et al. 1928:183–184, column VIII) under the name *Carex limosa–Sphagnum lindbergii*-Ass. (ICPN, Art. 7). The name is brought in accordance with the requirements of the Code, but it is not inverted, as the abundance of the upper graminoids layer does not exceed 25 % (Lapshina et al. 2022).

Synonyms and similar syntaxa: *Carex limosa–Sphagnum lindbergii*-Ass. Osvald 1925 (phantom), *Sphagnum lindbergii*-reiche–*Carex limosa*-Ass. Nordhagen 1927, Caricetum limosae subass. von *Sphagnum lindbergii* facies von *Carex limosa* Dierssen 1982, *Carex limosa–Sphagnum lindbergii* Passio 1933, Sphagnetum lindbergii caricetosum limosae Dahl 1956.

Ecology and distribution. The association is first mentioned by Osvald (1925) under the name *Carex limosa–Sphagnum lindbergii*-Ass. for northern Sweden, although the author does not provide its relevé. Later, the association has been repeatedly described in the mountains of Northern Scandinavia, where it is one of the most widespread in the poorly drained minerotrophic slope and aapa mires (Dierssen 1982). Occasionally, it occurs in the mountains of Central Europe on bogs along the shores of overgrowing lakes (Rudolph et al. 1928, Kasari 1972).

Note. Western European communities of the association develop under meso-oligotrophic conditions, as evidenced by the consistent presence in their composition of species like *Carex rostrata*, *C. chordorrhiza*, *Menyanthes trifoliata*. In northern Russia, these are primarily oligotrophic communities with a constant participation and often dominance of *Eriophorum russeolum*. Such relevés are provided by Ruuhijärvi (1960) for northern Finland (Table 4, Schlenkenweissmoore, rel. 21–24: 60). We distinguish them as a separate new subassociation (Lapshina et al. 2022).

The subass. **Carici limosae–Sphagnetum lindbergii typicum** fully corresponds to the diagnosis of the association and is automatically established based on the nomenclatural type of the association (autonyms) when dividing the latter into units of subordinate ranks [ICPN, Art. 5b, 13b].

Carici limosae–Sphagnetum lindbergii eriophoretosum russeoli subass. nov.

(Table 6, rel. 15–26, Table 8, syntaxon 20; Figs 4D, 2, cluster 13).

The subassociation encompasses oligotrophic *Eriophorum*-sedge-*Sphagnum* communities of waterlogged hollows dominated by *Carex limosa* and *Eriophorum russeolum* in the grass layer and *Sphagnum lindbergii* in the moss cover, occurring on raised *Sphagnum* bogs and palsa mires in northern Scandinavia, the European part of Russia, and Siberia.

Diagnostic species: *Carex limosa*, *Eriophorum ruseolum*, *Sphagnum lindbergii* (dom.).

Holotypus: relevé 18 (author's number 323E17nu) in Table 6, Beloyarsk District, Numto Nature Park, 16.08.2017, author E.D. Lapshina.

Synonyms: *Sphagnum lindbergii*-Rimpiweissmoore Ruuhijarvi 1960, Caricetum limosae sphagnetosum lindbergii (Osvald 1925) Dierssen 1982 (sensu Boch & Smagin 1993).

Structure and composition: The 15 to 20 cm high grass layer is composed of *Carex limosa* and *Eriophorum russeolum* in varying proportions. The total projected coverage varies from 10 to 40 % (averaging 25 %). A continuous moss layer is formed of *Sphagnum lindbergii* (Fig. 4D). A minor admixture includes *Sphagnum balticum*, *S. jensenii*, and *S. majus*. Scattered dwarf shrubs *Andromeda polifolia* and *Oxycoccus palustris*, as well as *Drosera anglica* and *D. rotundifolia*, are present.

Distribution and ecology. The communities of this subassociation are relatively rare within the nature park. They occur in the most waterlogged conditions of flat palsa mire complexes, enclosed thermokarst depressions, on floating mats along watercourses and small lakes, and in areas adjacent to thawing frozen peat mounds.

Sedge-peat moss communities dominated by *Carex limosa* and *Sphagnum lindbergii* are frequently found in northern Scandinavia (Ruuhijarvi 1960, Eurola 1962, Dierssen 1982), in the Northwest of Russia, as well as in northern Karelia and the White Sea region (Kuznetsov 1991, Boch & Smagin 1993). They have also been documented in the far northeast of Russia, where they occur on floating *Sphagnum* mats along the shores of mountain lakes at elevations of 800–900 m a.s.l. in the upper part of the forest belt (Sinelnikova 2009).

Note. Oligotrophic *Carex limosa*-peat moss and *Eriophorum russeolum*-peat moss communities dominated by *Sphagnum lindbergii* in the moss layer, exhibit remarkable consistency in their species composition across their entire range, extending from northern Scandinavia and the Central European mountains to the far northeast of Russia. In terms of overall species composition and appearance, they share similarities with the communities of the association Carici rotundatae–Sphagnetum lindbergii, which is widely distributed in the forest-tundra and southern tundra of Western Siberia. The main distinctions lie in the high constancy and noticeable abundance of the typically boreal species *Carex limosa*, and the absence of *Carex rotundata* in the communities. On the other hand, the notable abundance of *Eriophorum russeolum* and, most importantly, the absence of *Scheuchzeria palustris* differentiate these community types from similar oligotrophic mire syntaxa of the taiga zone.

Eriophoro russeoli–Warnstorfietum fluitantis

Lapshina et al. 2022 (Lapshina et al., 2022: 14–15, Table. 3, rel. 1–14) (Table 8, syntaxon 21, Fig. 2, cluster 14)

The association encompasses floristically poorly defined, but easily recognizable low-diversity communities dominated by *Warnstorfia fluitans*, characterized by green patches in yellow-brown oligotrophic *Sphagnum* lawns and hollows in flat palsa bogs and ridge-hollow raised bog complexes (Lapshina et al. 2022).

Diagnostic species: *Eriophorum russeolum*, *Warnstorfia fluitans* (dom.).

Structure and composition: The sparse 15–20 cm high grass layer (projective cover 10–25 %) is formed by *Eriophorum russeolum*, occasionally with a slight admixture of *Carex limosa* and less frequently *C. rotundata*. A continuous moss layer is formed by *Warnstorfia fluitans*.

Ecology and distribution. Communities of this association form in extensive flat *Sphagnum* hollows and floating mats in oligotrophic bog and palsa mire complexes in places where poor groundwater discharges occur. From the southern boundary of the northern taiga to the southern tundra, these communities do not occupy large areas, occurring in small patches on bogs. They are rare within the nature park.

Note. Physiognomically, the communities of this association resemble the association Drepanoclado fluitantis–Caricetum limosae Kästner et Flössner 1933 ex Kasari 1972, described in the Central European mountains (Chytrý 2011), but differ by the dominance of *Eriophorum russeolum* in the sparse grass layer and the absence of *Sphagnum cuspidatum*, which predominantly occurs in European communities.

Carici rotundatae–Sphagnetum baltici

Lapshina et al. 2022 (Table 7, rel. 13–40; Table 8, syntaxa 23, 24, Figs 4E, 2, clusters 15.1, 15.2)

Diagnostic species: *Carex rotundata*, *Eriophorum russeolum*, *Sphagnum balticum* (dom.).

The association was recently described in the northern West Siberia (Lapshina et al. 2022). It encompasses oligotrophic *Eriophorum russeolum-Carex rotundata*-peat moss communities dominated by *Sphagnum balticum* in the hollows and floating mats of oligotrophic mire complexes in the northern taiga, forest-tundra, and southern tundra.

Structure and composition. The grass layer, ranging from 15 to 30 cm in height, consists of varying proportions of *Carex rotundata* and *Eriophorum russeolum*. The overall cover of the grass layer ranges from 5 to 40 %, commonly 15 to 20 %. Dwarf shrubs, including *Andromeda polifolia*, *Oxycoccus palustris*, and *O. microcarpus*, occur in limited abundance. The continuous moss layer is composed of *Sphagnum balticum*, sometimes with a more or less noticeable admixture (up to 20–25 %) of *S. lindbergii*, *S. jensenii*, and *S. majus*. Other species such as *Calypogeia sphagnicola*, *Cladopodiella fluitans*, and *Warnstorfia fluitans* are occasionally found as single stems.

Distribution and ecology. Within the nature park, the association sporadically occur as small patches in the vast hollows of oligotrophic flat palsa mires and ridge-hollow complexes. It also develops in young thermokarst depressions within the frozen peat mounds of palsa mire complexes.

Based on the dominant species of the grass layer, two subas-

Table 8. Synoptic table of the syntaxa of the class Scheuchzerio–Caricetea nigrae in the Numto Nature Park, north taiga zone of Western Siberia: 1–3 – Sphagno warnstorfii–Tomentypnion nitentis, 4–9 – Sphagno–Caricion canescentis, 10–15 – Stygio–Caricion limosae, 16–24 – Scheuchzerion palustris. Abbreviations: (a) – tree layer.

Cluster nr. in the Fig. 4	**1.1**	**1.2**	**2**	**4**	**3.1**	**3.2**	**5**	**6.1**	**6.2**	**7.1a**	**7.1b**	**7.2**	**8**	**9**	**10**	**11.1**	**11.2**	**12.1**	**12.2**	**13**	**14**	**16**	**15.1**	**15.2**
Syntaxon nr. in the table	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**
Species of tree layer																								
Pinus sylvestris (a)	I	III^{r}	I	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Betula pubescens (a)	II	V^{+}	I	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Diagnostic species of the ass. Sphagno teretis–Betuletum nanae																								
Betula nana	**V^{2b}**	**V^{2b}**	III^{+}	·	·	I	III	·	·	·	·	·	·	I	·	·	·	·	·	·	·	I	·	·
Sphagnum angustifolium	**V^{2b}**	**IV^{2b}**	IV^{1}	·	·	·	·	·	II	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Carex magellanica	IV^{+}	V^{+}	IV^{+}	·	II	I	I	I	II	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Carex chordorrhiza **S.-C.**	IV^{+}	V^{+}	V^{1}	·	I	I	I	III^{+}	IV^{+}	II	·	III	·	I	·	·	·	·	·	·	·	·	·	·
Scapania paludicola	V^{+}	V^{+}	II	·	·	·	·	·	I	I	·	IV^{+}	II	·	·	·	·	·	·	·	·	·	·	·
Sphagnum squarrosum	IV^{+}	IV^{+}	·	·	·	·	·	·	III	I	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Sphagnum teres	III	III	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Schljakovia kunzeana	III	III	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Sphagnum fimbriatum	III^{1}	I	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Sphagnum centrale	III	II	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Pohlia nutans	II	III	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Cephalozia pleniceps	II	III^{+}	II	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Diagnostic species of the subass. S.t.–B. n. sphagnetosum warnstorfii and ass. Sphagno dioicae–Caricetum dioicae																								
Sphagnum warnstorfii	II	V^{3}	**V^{5}**	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Drosera rotundifolia	I	III^{+}	**V^{+}**	I	·	·	·	·	·	I	I	·	·	II	III^{+}	II	I	II	·	I	II	II	II	II
Diagnostic species of Sphagno warnstorfii–Tomentypnion nitentis																								
Aulacomnium palustre	V^{1}	V^{2a}	V^{+}	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Helodium blandowii	IV^{+}	V^{1}	III^{+}	·	·	·	·	·	III^{1}	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Straminergon stramineum	V^{+}	V^{+}	III^{+}	·	I	I	·	I	V^{1}	II	·	IV^{+}	·	·	·	·	·	·	I	·	·	·	·	I
Equisetum fluviatile **S.-C.**	II	V^{1}	V^{+}	·	·	·	II	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Calamagrostis neglecta	II	IV^{+}	·	·	I	·	·	·	III^{+}	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Carex diandra	R	II	II	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Paludella squarrosa	I	II	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Diagnostic species of the ass. Sphagno riparii–Menyanthetum trifoliatae and Sphagno riparii–Eriophoretum russeoli																								
Sphagnum riparium	III^{1}	III	·	**V^{5}**	**V^{5}**	**V^{5}**	I	I	III	·	·	I	·	·	·	I	R	·	·	·	·	·	·	I
Diagnostic species of the ass. Sphagno fallacis–Caricetum rostratae																								
Carex rostrata **S.-C.**	IV^{+}	I	·	·	II	**V^{3}**	**V^{3}**	III^{1}	II	I	I	II	II	I	II	·	R	·	·	·	·	·	I	·
Sphagnum fallax	·	·	·	I	·	I	**V^{5}**	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Diagnostic species of the ass. Sphagno obtusi–Comaretum palustris																								
Sphagnum obtusum	III	III	III^{+}	·	I	·	·	**V^{5}**	**V^{3}**	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Comarum palustre	·	V^{1}	III	·	I	II	II	IV^{+}	**V^{2b}**	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Sphagnum mirum	I	·	·	·	·	·	·	·	**V^{4}**	·	·	II	·	·	·	·	·	·	·	·	·	·	·	·
Diagnostic species of the Sphagno–Caricion canescentis																								
Carex canescens	·	·	·	·	II	I	·	II	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Epilobium palustre	I	I	·	·	I	·	·	I	III^{+}	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Eriophorum gracile	·	I	·	·	III^{+}	·	·	II	·	·	·	·	III^{r}	·	·	·	·	·	·	·	·	·	·	·
Diagnostic species of the Utriculario ochroleuco–Caricetum limosae																								
Gymnocolea inflata **S.-C.l.**	·	·	·	·	·	·	·	·	·	**V^{3}**	**V^{3}**	**V^{3}**	·	I	I	·	·	·	·	·	·	·	·	·
Sphagnum platyphyllum	·	·	·	·	·	·	·	·	·	III^{+}	II	II	·	II	·	·	·	·	·	·	·	·	·	·
Juncus stygius **S.-C.l.**	·	·	·	·	·	·	·	·	·	IV^{+}	·	V^{+}	·	·	·	·	·	·	·	·	·	·	·	·
Carex livida	·	·	·	·	·	·	·	·	·	·	·	III^{+}	·	·	·	·	·	·	·	·	·	·	·	·
Diagnostic species of the U. o.–C. l. subass. warnstorfietosum exannulati and *Carex limosa–Warnstorfia exannulata* com. type																								
Warnstorfia exannulata	II	III^{+}	I	·	·	·	·	·	·	II	·	V^{2b}	**V^{5}**	I	I	·	·	·	·	·	·	·	·	·
Utricularia minor **S.-C.l.**	·	·	·	·	·	·	·	·	·	·	·	·	III^{r}	I	·	·	·	·	·	·	·	·	·	·
Diagnostic species of the ass. Sphagno compacti–Caricetum limosae and the ass. Cladopodiello fluitantis–Trichophoretum cespitosae																								
Cladopodiella fluitans	·	·	·	·	·	·	·	·	·	II	IV^{1}	IV^{1}	·	**V^{3}**	**V^{2b}**	·	R	I	I	·	·	·	II	I
Sphagnum compactum	·	·	·	·	·	·	·	·	·	III^{+}	V^{2a}	III	·	**V^{2a}**	**V^{3}**	·	·	·	·	·	·	·	·	·
Trichophorum cespitosum	·	·	·	·	·	·	·	·	·	·	II	·	·	III	**V^{3}**	·	·	·	·	·	·	·	·	·
Diagnostic species of the Stygio–Caricion limosae																								
Drosera anglica	·	·	·	·	·	·	·	·	·	II	III^{r}	II	·	II	·	·	·	III^{r}	I	II	III^{r}	·	I	I
Drosera obovata	·	·	·	·	·	·	·	·	·	V^{+}	II	V^{+}	·	V^{1}	I	·	·	·	·	·	·	·	·	I
Utricularia ochroleuca	·	·	·	·	·	·	·	·	·	V^{1}	I	V^{+}	IV^{+}	I	·	·	·	·	·	·	·	·	·	·
Diagnostic species of the ass. Scheuchzerio palustris–Sphagnetum jensenii																								
Scheuchzeria palustris **S.p.**	I	·	·	·	I	·	·	II	·	II	II	·	·	II	·	**V^{2a}**	**IV^{2b}**	·	·	I	·	·	·	I
Sphagnum jensenii **S.p.**	I	·	·	III	I	·	·	·	·	II	II	·	II	II	III	**V^{5}**	**IV^{2a}**	II	II	III^{+}	II	·	II	I
Sphagnum majus **S.p.**	·	·	·	·	I	I	·	II^{2b}	·	II	IV^{+}	I	II	V^{1}	III	III	**V^{5}**	II	I	II	III^{+}	I	III	·
Diagnostic species of the ass. Carici rotundatae–Sphagnetum lindbergii																								
Carex rotundata **C.r.-S.b.**	·	·	·	·	·	I	I	·	·	II	IV^{+}	I	·	III	III^{r}	·	R	**V^{2a}**	III^{r}	I	·	I	**V^{2b}**	I
Sphagnum lindbergii **S.p.**	I	·	·	II	I	I	I	·	·	I	IV^{+}	II	·	II	II	I	I	**V^{5}**	**V^{5}**	**V^{5}**	IV^{+}	I	II	III
Diagnostic species of the com. type *Eriophorum russeolum–Warnstorfia fluitans*																								
Warnstorfia fluitans **S.-C.l.**	II	II	·	·	I	I	·	·	I	III^{+}	IV^{+}	III	·	IV^{+}	I	I	I	I	II	II	**V^{5}**	·	I	I
Diagnostic species of the ass. Eriophoro vaginati–Sphagnetum baltici and Carici rotundatae–Sphagnetum baltici																								
Eriophorum vaginatum	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	**V^{2b}**	I	·
Sphagnum balticum	·	·	·	·	·	·	·	·	·	·	·	·	·	I	I	II	R	IV^{2a}	IV^{2a}	III^{+}	II	**V^{5}**	**V^{5}**	**V^{5}**
Eriophorum russeolum	·	·	·	**V^{2b}**	II	I	·	III	·	IV^{+}	IV^{+}	III^{r}	III^{r}	III^{+}	·	IV^{+}	V^{+}	IV^{+}	**V^{2a}**	V^{1}	V^{2a}	I	IV^{+}	**V^{2b}**
Diagnostic species of the Scheuchzerio–Caricetea nigrae																								
Carex limosa	IV^{+}	III^{+}	V^{1}	·	IV^{+}	I	·	V^{1}	V^{2a}	V^{2a}	V^{2a}	V^{2a}	V^{2a}	V^{1}	I	V^{+}	V^{1}	II	I	**V^{1}**	III^{r}	II	III^{+}	III
Oxycoccus palustris	V^{1}	V^{1}	V^{2b}	IV^{+}	IV^{+}	III	V^{1}	IV^{+}	V^{1}	I	I	·	II	III	IV^{+}	III^{+}	III^{+}	IV^{+}	IV^{+}	III	·	V^{1}	V^{+}	V^{1}
Menyanthes trifoliata	V^{2b}	V^{2b}	V^{2b}	·	V^{3}	V^{1}	IV^{+}	V^{2b}	I	V^{1}	V^{1}	V^{2a}	V^{2b}	V^{+}	II	I	II	·	I	I	III^{+}	·	I	·

Table 8. Continued.

Syntaxon nr. in the table	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Andromeda polifolia	V^{2a}	V^{1}	IV^{2a}	·	·	I	III^{+}	·	II	I	II	II	·	II	V^{1}	I	I	V^{+}	II	II	II	IV^{1}	IV^{+}	III
Eriophorum angustifolium	IV^{+}	I	II	·	III	I	I	II	III^{r}	IV^{+}	II	III^{r}	III^{r}	III	IV^{+}	I	R	III^{r}	II	I	·	·	I	I

Note. Diagnostic species (next to the name of the taxon): **S.-C.** – Scheuchzerio–Caricetea nigrae, **S.-C.l.** – Stygio–Caricion limosae, **S.p.** – Scheuchzerion palustris, **C.r.-S.b.** – Carici rotundatae–Sphagnetum baltici.
The numbers of syntaxa correspond to the numbers in Fig. 2.

sociations are distinguished within the association: typicum and eriophoretosum russeoli.

Carici rotundatae–Sphagnetum baltici subass. typicum (Table 7, rel. 13–23; Table 8, syntaxon 23, Fig. 2, cluster 15.1)

Diagnostic species: *Carex rotundata* (dom.), *Sphagnum balticum* (dom.).

Structure and composition. The subassociation comprises low-diversity communities dominated by *Carex rotundata* and *Sphagnum balticum*. The grass layer is formed by *Carex rotundata* (5–30 %). *Eriophorum russeolum*, *Carex limosa*, and *Drosera rotundifolia* are present in limited abundance alongside it. Scattered dwarf shrubs include *Andromeda polifolia*, *Oxycoccus palustris*, and occasionally *Chamaedaphne calyculata*. The continuous moss cover is formed by *Sphagnum balticum*, with occasional scattered stems of small liverworts interspersed within it.

Distribution and ecology. Same as in the association.

Regarding the composition of the moss cover, three variants have been identified:

The variant typica fully aligns with the subassociation's description and is characterized by the dominance of *Sphagnum balticum*.

The variants Sphagnum lindbergii and Sphagnum jensenii are found in more waterlogged conditions and are distinguished by a more or less noticeable mixture of *Sphagnum lindbergii* and *S. jensenii*, or *S. majus*, respectively.

Carici rotundatae–Sphagnetum baltici subass. eriophoretosum russeoli Lapshina et al. 2022 (Table 7, rel. 24–40; Table 8, syntaxon 24, Fig. 2, cluster 15.2)

The subassociation comprises oligotrophic communities dominated by *Eriophorum russeolum* and *Sphagnum balticum*.

Diagnostic species: *Eriophorum russeolum* (dom.), *Sphagnum balticum* (dom.).

Structure and composition. A uniform grass layer, 15–25 cm in height, is formed by *Eriophorum russeolum* (cover up to 25 %) with minor admixtures of *Carex limosa*. Dwarf shrubs, predominantly *Oxycoccus palustris* and occasionally *Andromeda polifolia*, show high consistency. The continuous moss cover is composed of *Sphagnum balticum*, sometimes with an admixture of *S. lindbergii*. Unlike similar communities widely distributed in the forest-tundra and southern tundra of Western Siberia (Lapshina et al. 2022), *Carex rotundata* is practically absent in the subassociation's peat-moss communities on the southern border of the Numto Nature Park.

Distribution and ecology. The communities of this subassociation are found in waterlogged floating lawns and hollows of flat palsa mire complexes, but in wetter conditions compared to the communities of the typical subassociation.

Regarding the structure of the moss cover, two variants are distinguished: typica and Sphagnum lindbergii. The variant typica (Table 7, rel. 24–34) fully corresponds to the subassociation's diagnostic criteria. The variant Sphagnum lindbergii (Table 7, rel. 35–40) differs by having a more or less noticeable admixture of *Sphagnum lindbergii* in the moss cover.

Eriophoro vaginati–Sphagnetum baltici Bogdanowskaya-Guihéneuf 1928 (Table 7, rel. 1–12; Table 8, syntaxon 22; Figs 4F, 2, cluster 16).

The association was described by Bogdanowskaya-Guihéneuf (1928) in the oligotrophic raised bogs of the Baltic region and was recently validated by Lapshina et al. (2022). The association's name is not inverted, with the dominant moss species remaining in the second place, which in all communities has a canopy cover of not less than 80 % (typically 100 %).

Diagnostic species: *Eriophorum vaginatum*, *Sphagnum balticum* (dom.).

Structure and composition. The association encompasses oligotrophic *Eriophorum vaginatum*–peat moss communities dominated by *Sphagnum balticum*, forming a continuous moss cover. Flat tussocks of *Eriophorum vaginatum* are scattered across, with a cover of 5–25 %, occasionally higher (Fig. 4F). Sparse dwarf shrub layers are composed of *Andromeda polifolia*, *Chamaedaphne calyculata*, and *Oxycoccus palustris*. Also, in low abundance, species from the class Oxycocco-Sphagnetea are often present – *Drosera rotundifolia*, *Oxycoccus microcarpus*, *Rubus chamaemorus*, *Sphagnum divinum*, and *Mylia anomala*.

Distribution and ecology. The nano-relief is sparsely tussocky, formed by the low tussocks of *Eriophorum vaginatum*, slightly elevated above the surface of the *Sphagnum* mosses that fill all the spaces between them. The relative height difference is about 3–5 (10) cm. The water table sits approximately 10–15 cm below the surface of the moss carpet.

This association regularly occurs in Finland (Ruuhijärvi 1960, Eurola 1962), in the boreal zone of the European part of Russia (Kuznetsov 1991, Smagin 2011), and in northern Belarus (Zelenkevich et al. 2016). However, it attains its greatest distribution in a continental climate on ombrotrophic raised bog complexes within the forest zone of Western Siberia (Lapshina 2010).

Prodromus

Prodromus of the syntaxa of the class Scheuchzerio–Caricetea nigrae distinguished and described in the Numto Nature Park is given below (in bold, the syntaxa that were described for the first time, validated, or had their syntaxonomic rank changed are highlighted).

Class
Order
Alliance
Association / Community type
Subassociation
Variant

Scheuchzerio palustris–Caricetea nigrae Tx. 1937

Sphagno warnstorfii–Tomentypnetalia Lapshina 2010

Sphagno warnstorfii–Tomentypnion nitentis Dahl 1957

Sphagno teretis–Betuletum nanae Lapshina et al. 2018

typicum

sphagnetosum warnstorfii **subass. nov.**

Sphagno warnstorfii–Caricetum dioicae Lapshina 2010

Carex chordorrhiza

Caricetalia nigrae Koch 1926

Sphagno–Caricion canescentis Passarge 1978

Sphagno riparii–Menyanthetum trifoliatae **ass. nov.**

typicum **subass. nov.**

caricetosum rostratae (Osvald 1925) s**tat. nov.**

Sphagno riparii–Eriophoretum russeoli **ass. nov.**

Sphagno fallacis–Caricetum rostratae Osvald ex Lapshina nom. ivers. mut.

Sphagno obtusi–Comaretum palustris **ass. nov.**

typicum **subass. nov.**

typica

Sphagnum majus

sphagnetosum miri **subass. nov.**

Stygio–Caricion limosae Nordhagen 1943

Utriculario ochroleuco–Caricetum limosae Lapshina et al. 2022

typicum

inops

warnstorfietosum exannulatae Lapshina et al. 2022

typica

Carex livida

Carex limosa–Warnstorfia exannulata

Sphagno compacti–Caricetum limosae **ass. nov.**

Cladopodiello–Trichophoretum cespitosi Smagin ex Lapshina in Lapshina et al. 2022

sphagnetosum compacti Lapshina et al. 2022

Scheuchzerietalia palustris Nordhagen 1936 ex Tx. 1937

Scheuchzetion palustris Nordhagen ex Tx. 1937

Scheuchzerio palustris–Sphagnetum jensenii **ass. nov.**

typicum **subass. nov.**

typica

Sphagnum majus

sphagnetosum majoris **subass. nov.**

typica

Sphagnum jensenii

Carici rotundatae–Sphagnetum lindbergii Nordhagen ex Lapshina et al. 2022

typicum

typica

Sphagnum balticum

eriophoretosum russeoli Lapshina et al. 2022

typica

Sphagnum balticum

Carici limosae–Sphagnetum lindbergii Rudolph et al. 1928

eriophoretosum russeoli subass. nov.

Eriophoro russeoli–Warnstorfietum fluitantis Lapshina et al. 2022

Carici rotundatae–Sphagnetum baltici Lapshina et al. 2022

typicum

eriophoretosum russeoli Lapshina et al. 2022

typica

Sphagnum lindbergii

Eriophoro vaginati–Sphagnetum baltici Bogdanowskaya-Guihéneuf 1928

DISCUSSION

Within the territory of the Numto Nature Park, the class Scheuchzerio–Caricetea nigrae is represented by four unions belonging to three orders: Sphagno warnstorfii–Tomentypnetalia, Caricetalia nigrae, and Scheuchzerietalia palustris. Due to the predominance of sandy soils and the poverty of surface and groundwater, various oligotrophic and meso-oligotrophic communities of upland bogs and poor transitional peat-moss bogs predominate significantly. Vegetation of minerotrophic bogs fed by moderately rich groundwater occupies very limited areas.

The order Sphagno warnstorfii–Tomentypnetalia includes two alliances – Saxifrago–Tomentypnion nitentis and Sphagno warnstorfii–Tomentypnion nitentis (Lapshina 2010), of which only the latter is represented in the territory of the Numto Nature Park. Communities of this alliance represent the initial stage of oligotrophication in the vegetation of minerotrophic sedge-grass-moss moderately rich bogs. They are found in the valleys of small rivers and creek headwaters in the central part of the Numto Nature Park and are represented by two associations previously described in the literature (Lapshina 2010, Lapshina et al. 2018).

The association Sphagno teretis–Betuletum nanae by floristic composition occupies an intermediate position between the syntaxa of its alliance and the most species-rich communities of the alliance Sphagno–Caricion canescentis of the order Caricetalia nigrae Koch 1926. Taking into account the presence of a clear set of diagnostic species from the alliance Sphagno warnstorfii–Tomentypnion nitentis and the significant presence of *Sphagnum teres*, *S. warnstorfii*, as well as the absence or much smaller participation of typical representatives of the alliance Sphagno–Caricion canescentis (*Carex canescens*, *Sphagnum fallax*, *S. obtusum*, *S. riparium*), we consider these communities to be part of the alliance Sphagno warnstorfii–Tomentypnion nitentis.

The association Sphagno warnstorfii–Caricetum dioicae occurs sporadically in mineralotrophic bogs with moderately rich mineral nutrition and groundwater throughout the forest zone of Western Siberia, but never occupies extensive territories. On the territory of the natural park these association communities are on the northern border of the range. Despite the absence of *Carex dioica* in the dwarf shrub-grass layer and pronounced dominance of *Carex chordorrhiza*, the general species composition and similar physiognomy make it easy to recognize (identify) these rare communities in natural conditions.

Within the nature park, the order Caricetalia nigrae includes seven associations with subassociations and variants, as well as one community type, which we assigned to two alliances: Sphagno–Caricion canescentis and Stygio–Caricion limosae.

In the syntaxonomic literature, the vegetation of the alliance Sphagno–Caricion canescentis was previously considered as part of the alliance Caricion lasiocarpae Vanden Bergen in Lebrun et al. 1949. Recently, due to numerous misinterpretations, it has been suggested that the use

of this name should be abandoned entirely (Mucina et al. 2016, Theurillat et al. 2021, ICPN Art. 36). However, most communities within mesotrophic and meso-oligotrophic tall-sedge-*Sphagnum* mires still continue to be included in two large associations, Caricetum lasiocarpae Vanden Bergen in Lebrun et al. 1949 and Caricetum rostratae Rübel ex Osvald 1923. Within each of these associations there are between 7 and 12 sub-associations based on the dominant moss species. This results in these associations being amorphous and not consistent with the original diagnoses of the originally described sedge communities (Diersen 1982, Boch & Smagin 1993, Smagin 2012, Zelenkevich et al. 2016).

Carex lasiocarpa communities are extremely rare in the study area due to poor soils and groundwater and occur only in small fragments. Communities with *Carex rostrata* participation or dominance are much more widespread. These communities represent the main phytocoenotic diversity within the alliance Sphagno–Caricion canescentis.

We used statistical methods of relevé analysis to determine floristic similarity between communities with respect to species abundance. It was shown that the classification of the entire dataset of mesotrophic sedge-*Sphagnum* communities within the alliance Sphagno–Caricion canescentis into distinct and well-defined clusters, i.e. associations, is not based on vascular plant species, but on dominant moss species. On a finer scale, these associations are subdivided into subordinate units, subassociations, depending on the dominant species of the herbaceous layer (Figs 2, 3).

Based on the results of statistical analysis, we identified three new associations: Sphagno riparii–Menyanthetum trifoliatae **ass. nov.**, Sphagno riparii–Eriophoretum russeoli **ass. nov.** and Sphagno obtusi–Comaretum palustris **ass. nov.** These associations are understood in a narrower sense than that adopted in the Braun-Blanquet system for similar community types. The newly identified associations have a common species composition, which is explained by their belonging to the same alliance, but they differ markedly in appearance (dominants), ecological conditions (water level and availability of mineral nutrients) of habitats, area occupied and position in bog complexes. The association Sphagno fallacis–Caricetum rostratae (Fig. 3), which occupies the northern limit of distribution in the taiga zone of the Numto Nature Park and is represented by a limited number of relicts, stands somewhat apart.

Communities of the alliance Stygio–Caricion limosae have much in common in terms of species composition and general physiognomic appearance with low-sedge communities of the order Scheuchzerietalia palustris. This is also evident from the clustering dendrogram (Fig. 3). However, for now we placed them in the order Caricetalia nigrae, on the basis that the original concept of this order included the alliance Rhynchosporion albae Koch 1926 (ICPN, Art. 36), which was replaced by the Stygio–Caricion limosae in the modern structure of the class Scheuchzerio–Caricetea (Peterka et al. 2017).

A total of three associations, three subassociations and one community type of the alliance Stygio–Caricion limosae have been identified in the Numto Nature Park. In addition to two previously described associations – Utricularo ochroleuco–Caricetum limosae and Cladopodiello–Trichophoretum cespitososi with corresponding subassociations, a new association Sphagno compacti–Caricetum limosae **ass. nov.**, has been revealed.

This association is differentiated from the communities of the association Utricularo ochroleuco–Caricetum limosae by a distinct group of species from the alliance Scheuchzerion palustris: *Carex limosa*, *C. rotundata*, *Eriophorum russeolum*, *Scheuchzeria palustris*, and oligotrophic peat moss species such as *Sphagnum jensenii*, *S. lindbergii*, *S. majus*, and *S. papillosum*. In contrast, the diagnostic group of the alliance Stygio–Caricion limosae is primarily represented by species with a broader range that occur in communities of both alliances, including *Drosera anglica*, *Menyanthes trifoliata*, *Sphagnum compactum*, and *Warnstorfia fluitans*.

The alliance Stygio–Caricion limosae is indicated by poor development of *Sphagnum* mosses, predominance and sometimes dominance of *Gymnocolea inflata* along with *Cladopodiella fluitans* in the ground cover, as well as the presence, although in small numbers, of such diagnostic species of this alliance as *Drosera obovata* and *Sphagnum platyphyllum*.

In the central and northern parts of the Numto Nature Park, a new variant inops of the typical subassociation of the association Utricularo ochroleuco–Caricetum limosae was described. The communities of this variant differ from the communities of the southern part of the northern taiga subzone by the reduced frequency of occurrence and absence of some diagnostic species of the association. In general, the communities of the alliance differ well in physiognomic, ecological and species characteristics.

Five associations, seven sub-associations with variants and one community type were identified within the alliance Scheuchzetion palustris in the Numto Nature Park. The association Carici limosae–Sphagnetum jensenii, previously described on the basis of limited material, is widely distributed in the southern part of the nature park. This widespread distribution allowed its validation by a large number of relevés. Communities of this association have been repeatedly described in the European part of Russia, where they vicariously replace predominantly Western European associations in oligotrophic hollows of raised bogs. These Western European associations consist of similar sedge-*Scheuchzeria*-peat communities dominated by *Sphagnum cuspidatum*. The Western European communities developed in a sub-Atlantic mild temperate climate under meso-oligotrophic conditions, as evidenced by the persistent presence, albeit low abundance, of species such as *Carex rostrata*, *C. chordorrhiza* and *Menyanthes trifoliata*.

The described association Carici limosae–Sphagnetum jensenii **ass. nov.**, unlike similar western communities, is distributed in the boreal zone and is characterised by the presence of hypoarctic species such as *Eriophorum russeolum* and *Sphagnum lindbergii*. The frequency of occurrence of these species increases from west to east. The phytocoenotic activity of *Sphagnum jensenii*, absent in Western Europe and rare in the European part of Russia, increases in the same direction. In the moderately continental climate

of Western Siberia, *S. jensenii* coexists with *S. majus* and often dominates.

Further studies and involvement of additional materials will make it possible to show more fully the differences between the association Carici limosae–Sphagnetum jensenii and similar sedge (*Carex limosa*)-*Scheuchzeria*-peat moss communities of oligotrophic hollows dominated by *Sphagnum balticum*. The latter are widespread in the conditions of continental climate of the middle and southern subzones of the taiga zone of Western Siberia and also differ from those in Western Europe.

The association Carici limosae–Sphagnetum lindbergi, previously described in Northern Scandinavia and in the mountains of Central Europe (Rudolph et al. 1928, Kasari 1972, Dierssen 1982), was validated. In contrast to typical communities developing under meso-oligotrophic conditions, in northern European Russia and Western Siberia this association is represented by a distinct strictly oligotrophic subassociation, eriophoretosum russeoli **subass. nov.**, with participation of *Eriophorum russeolum*.

Syntaxonomically, they occupy an intermediate position between closely related syntaxa in the north of the taiga zone of Western Siberia with *Scheuchzeria palustris* and communities of the association Carici rotundatae–Sphagnetum lindbergii, which are widely distributed in the forest tundra and southern tundra of Western Siberia.

The results of statistical analysis analysis of relevés showed that low-productive sedge-moss-liverworts and sedge-moss-*Sphagnum* communities of the alliances Stygio–Caricion limosae and Scheuchzerion palustris, as well as mesotrophic and meso-oligotrophic communities of the alliance Sphagno–Caricion canescentis with high cover by vascular plants are divided into well-defined clusters: associations based on dominant moss species in the ground cover. Subassociations are distinguished first of all by the dominance of the species of the herbaceous layer, which determines the external appearance of the communities, and less often by the similar composition of vascular plants based on the dominant species of peat moss.

In species-poor communities closely associated with habitats where water levels are close to the surface, the dominance of individual species, particularly mosses, is crucial for classifying mire vegetation (Lapshina et al. 2018). Unlike vascular plants, mosses are more sensitive to the ecological conditions of habitats, primarily substrate reaction (pH) and mineral nutrient richness. This ultimately determines the entire floristic composition of communities and their belonging to higher ranks – alliances and orders.

This study contributes to a better understanding of the ecological and floristic features of the park's ecosystems, which can be instrumental in its conservation, management and future scientific research.

CONCLUSIONS

Generalisation of the results of phytosociological studies conducted to investigate the syntaxonomic diversity of the largest class of mire vegetation, the Scheuchzerio–Caricetea nigrae, in the Numto Nature Park allowed us to expand the previous studies and to represent the typological diversity of this vegetation in the entire subzone of the northern taiga of Western Siberia.

In the northern part of the forest zone, vegetation on mineralotrophic mires with moderately rich nutrition occupies very limited areas. There are no sedge-moss (*Scorpidium* spp.) communities belonging to the alliance Caricion stantis Matveyeva 1994, common in waterlogged depressions of polygonal and flat-topped bogs in the tundra zone. Communities of nutrient-rich mineralotrophic bogs dominated by *Sphagnum warnstorfii* of the alliance Sphagno warnstorfii–Tomentypnion nitentis are very rare and sporadic in the valleys of small rivers and sources of streams with underground runoff.

The main syntaxonomic diversity of the class Scheuchzerio–Caricetea in the northern taiga subzone of Western Siberia is represented by: communities of poor transitional sedge-*Sphagnum* fens of the alliance Sphagno-Caricion canescentis; oligotrophic floating mats and waterlogged hollows with slightly acidic substrate reaction of the alliance Stygio–Caricion limosae; and ombrotrophic cottongrass-sedge-*Sphagnum* hollow communities with extremely acidic substrate reaction of the alliance Scheuchzerion palustris. Many of the described mire communities of the northern forest zone of Western Siberia are also found in northern Scandinavia, the Kola Peninsula, Karelia, Arkhangelsk Region and the Komi Republic.

In low-diversity plant communities of floating *Sphagnum* lawns and waterlogged hollows of the class Scheuchzerio–Caricetea, the dominant species of the moss layer plays a decisive role, as it is more sensitive to the ecological conditions of the habitat, especially to the substrate reaction (pH) and mineral richness. These factors ultimately determine the entire floristic composition and the classification of communities into syntaxa (alliances, orders) of higher rank. Accordingly, subassociations can be distinguished by the dominant moss species or, more often, by the dominant grass layer, which gives mire communities a characteristic physiognomy that allows their identification in the field.

ACKNOWLEDGEMENTS

The research was carried out with the financial support of a grant of Government of the Tyumen Region as part of the national "Science" project and the program of activities of the West Siberian Interregional Scientific and Educational Center Of The World Level.

LITERATURE CITED

Abramova, T.G. 1951. Materials on the connection between the vegetation cover of the upper peat bog and some properties of its upper peat layers. *Uchenye zapiski Leningradskogo gosudarstvennogo universiteta. Seriya biologicheskaya. Geobotanika* 30(143):220–250 (in Russian). [Абрамова Т.Г. 1951. Материалы к вопросу о связи между растительным покровом верхового болота и некоторыми свойствами верхних слоев его торфяной залежи // Ученые записки Ленинградского государственного университета. Серия биологическая. Геоботаника. Вып. 30, № 143. С. 220–250].

Barkman, J.J., H. Doing & S. Segal 1964. Kritische Bemerkungen und Vorschläge zur quantitativen Vegetationsanalyse. *Acta Botanica Neerlandica* 13(3):394–419.

Blagoveshchenskiy, I.V. 2006. *Structure of the vegetation cover, systematic, geographic, and eco-biological analysis of the flora of mire ecosystems in the central part of the Volga Upland: Abstract diss. dr. biol. siences, 03.00.16*. Ul'yanovsk, 41 pp. (in Russian). [Благовещенский И.В. 2006. Структура растительного покрова, систематический, географический и эколого-биологический анализ флоры болотных экосистем центральной части Приволжской возвышенности: автореф. дисс. … д-ра биол. наук: 03.00.16. Ульяновск. 41 с.]

Bogdanowskaya-Guihéneuf, I.D. 1928. Vegetation cover of raised bogs in the Russian Baltic region. *Trudy Petergofskogo Estestvenno-nauchnogo Instituta* 5:265–377 (in Russian). [Растительный покров верховых болот Русской Прибалтики // Труды Петергофского естественно-научного института. № 5. С. 265–377].

Boch, M.S. & V.A. Smagin 1993. *Flora and vegetation of mires in the North-West Russia and principles of their protection*. Gidrometeoizdat, Saint Petersburg, 225 pp. (in Russian). [Боч М.С., Смагин В.А. 1993. Флора и растительность болот Северо-Запада России и принципы их охраны. СПб.: Гидрометеоиздат. 224 с.]

Boch, M.S. & V.I. Vasilevich 1980. Bogs of the Pechora and Ilych uprivers (northern Pre-Urals). In: *Bogs of the European North of the USSR* (V.D. Lopatin, ed.), pp. 42–75, Nauka, Petrozavodsk (in Russian). [Боч М.С., Василевич В.И. 1980. Болота верховьев рек Печоры и Илыча (северное Предуралье) // Болота Европейского Севера СССР/ науч. ред. В.Д. Лопатин. Петрозаводск: Наука. С. 42–75].

Chytry, M. (ed.) 2011. *Vegetation of the Czech Republic. 3. Aquatic and Wetland Vegetation*. Academia, Praha, 827 pp.

Dierssen, K. 1982. *Die wichtigsten Pflanzengesellschaften der Moore NW-Europas*. Genève. 382 S.

Eurola S. 1962. Über die regionale Einteilung der südfinnischen Moore. *Annales Botanici Societatis Zoologicae-Botanicae Fennicae Vanamo* 33(2):1–243.

Galanina, O.V. 2004. *Vegetation of Sphagnum bogs and its mapping in the southwest taiga Region: Abstract diss. … cand. biol. siences, 03.00.05*. St. Petersburg, 19 pp. (in Russian). [Галанина О.В. 2004. Растительность сфагновых болот и ее картографирование на юго-западе таежной области: автореф. дисс. … канд. биол. наук: 03.00.05. СПб. 19 с.]

Gillet, F. 1982. L'alliance du Sphagno–Tomenthypnion Dans le Jura. *Documents phytosociologiques, NS* 6:155–180.

Goncharova, N.N. 2007. *Flora and vegetation of bogs in the southwest of the Komi Republic: Abstract diss. … cand. biol. siences, 03.00.05*. Petrozavodsk, 19 pp. (in Russian). [Гончарова Н.Н. 2007. Флора и растительность болот юго-запада республики Коми: автореф. дисс. … канд. биол. наук: 03.00.05. Петрозаводск. 19 с.]

Ignatov, M.S., O.M. Afonina, E.A. Ignatova, A.A. Abolina, T.V. Akatova, E.Z. Baisheva, L.V. Bardunov et al. 2006. Check-list of mosses of East Europe and North Asia. *Arctoa* 15:1–130 (in Russian with English summary). [Игнатов М.С., Афонина О.М., Игнатова Е.А., Аболиня А.А., Акатова Т.В., Баишева Э.З., Бардунов Л.В. и др. 2006. Список мхов Восточной Европы и Северной Азии // Arctoa. Т. 15. С. 1–130].

Konstantinova, N.A., V.A. Bakalin, E.N. Andrejeva, A.G. Bezgodov, E.A. Borovichev, M.V. Dulin & Yu.S. Mamontov 2009. Checklist of liverworts (Marchantiophyta) of Russia. *Arctoa* 18: 1–64.

Kuznetsov, O.L. 1991. Ecological-floristic classification of the *Sphagnum* bog communities. In: *Research methods of the taiga mire ecosystems* (O.L. Kuznetsov, ed.), pp. 4–24, Nauka, Leningrad (in Russion). [Кузнецов О.Л. 1991. Эколого-флористическая классификация сфагновых сообществ болот // Методы исследования болотных экосистем таежной зоны / отв. ред. О.Л. Кузнецов. Л.: Наука. С. 4–24].

Kuznetsov, O.L. 2005. Topological-ecological classification of mire vegetation of Karelia (ombrotrophic and oligotrophic communities). In: *Biodiversity, Dynamics, and Resources of Bog Ecosystems in Eastern Fennoscandia (Trudy Karel'skogo nauchnogo tsentra rossiyskoy akademii nauk, issue 8)* (O.L. Kuznetsov, ed.), pp. 15–46, Petrozavodsk (in Russian). [Кузнецов О.Л. 2005. Тополого-экологическая классификация растительности болот Карелии (омбротрофные и олиготрофные сообщества) // Биоразнообразие, динамика и ресурсы болотных экосистем восточной Фенноскандии (Тр. Кар. НЦ РАН. Вып. 8) / под. ред. О.Л. Кузнецова. С. 15–46].

Lapshina, E.D. 2010. *Vegetation of bogs in the southeast of Western Siberia*. Redaktsionno-izdatel'skiy tsentr NGU, Novosibirsk, 168 pp. (in Russian). [Лапшина Е.Д. 2010. Растительность болот юго-востока Западной Сибири. Новосибирск: Редакционно-издательский центр НГУ. 168 с.].

Lapshina, E.D., G.N. Ganasevich, A.L. Vasina 2018. Rare plants and plant communities of rich fens of "Malaya Sosva" Nature Reserve (Western Siberia). *Environmental dynamics and climate change* 9(1):72–92 (in Russian). [Лапшина Е.Д., Ганасевич Г.Н., Васина А.Л. 2018. Редкие растения и растительные сообщества болот богатого грунтового питания заповедника "Малая Сосьва" (Западная Сибирь) // Динамика окружающей среды и глобальные изменения климата. Т. 9, № 1. С. 72–92].

Lapshina, E.D., I.V. Filippov, V.E. Fedosov, Yu.V. Skuchas, P. Lamkowski & I.N. Pospelov 2021. The vegetation of the class Scheuchzerio–Caricetea fuscae Tx. 1937 in the Yanganape mountain massif area (Eastern macroslope of the Polar Urals). *Rastitel'nost' Rossii* 41:113–149 (in Russian with English Summary). [Лапшина Е.Д., Филиппов И.В., Федосов В.Э., Скучас Ю.В., Ламковски П., Поспелов И.Н. 2021. Растительность класса Scheuchzerio–Caricetea fuscae Tx. 1937 в районе горного массива Янганапэ (восточный макросклон Полярного Урала) // Растительность России. № 41. С. 113–149].

Lapshina, E.D., I.V. Filipov & G.N. Ganasevich 2022. Low-sedge vegetation of waterlogged bog hollows and fens in the north of Western Siberia. *Rastitel'nost' Rossii* 45:3–38 (in Russian with English Summary). [Лапшина Е.Д., Филиппов И.В., Ганасевич Г.Н. 2022. Мелкоосоковые сообщества топей и мочажин болот севера Западной Сибири // Растительность России. № 45. С. 3–38].

Lapshina, E.D. A.I. Maksimov & P. Lamkowski 2023a. *Sphagnum inexspectatum* Flatberg, *S. mirum* Flatberg & Thingsgaard: their distrebution and habitat preferences in Western Siberia. *Botanica Pacifica* 12(1):89–100.

Lapshina, E.D., I.V. Filippov, E.L. Verevkina & G.N. Ganasevich 2024. Syntaxonomy of the Numto Nature Park vegetation (north taiga, Western Siberia): 1. Vaccinio–Piceetea Br.-Bl. in Br.-Bl et al. 1939. *Botanica Pacifica* 13(1).

Moskovchenko, D.V. (ed.) 2017. Park Numto: Nature and cultural heritage. "Surgutneftegaz", Reklamno-izdatel'ski informatsionnyi centr "Neft' Priob'ya", Surgut, 150 pp. (in Russian). [Парк «Нумто». Природа и историко-культурное наследие. 2017 / под ред. Д.В. Московченко. Сургут: ОАО «Сургутнефтегаз», Рекламно-издательский центр «Нефть Приобья», 150 с.].

Mucina, L., H. Bültmann, K. Dierßen, J.-P. Theurillat, T. Raus, A. Čarni, K. Šumberová, et al. 2016. Vegetation of Europe: hierarchical floristic classification system of vascular plant, bryophyte, lichen, and algal communities. *Applied Vegetation Science* 19(1): 3–264.

Osvald, H. 1923. *Die Vegetation des Hochmoores Komosse. Svenska Växtsociol.* Sällskapets Handl, Upsala, 436 pp.

Osvald, H. 1925. *Zur Vegetation der ozenischen Hochmoore in Norvegen*. Uppsala. 106 S.

Panarctic Flora. Available from: http://www.binran.ru/resources/archive/paf/ Last accessed 14.01.2022.

Passarge, H. 1964. Pflanzengesellschaften der nordostdeutschen Flachlandes I. *Pflanzensoziologie* 13:1–436.

Peterka, T., M. Hájek, M. Jiroušek, B. Jiménez-Alfaro, L. Aunina, A. Bergamini, D. Dítě, et al. 2017. Formalized classification of European fen vegetation at the alliance level. *Applied Vegetation Science* 20: 124–142.

Romanova, E.A., R.T. Bybina, E.F. Golitsina, G.M. Ivanova, L.I. Usova & L. Trushnikova 1977. *Typological map of the bogs of the West Siberian Plain. Scale 1:2 500 000*. St. Petersburg, 500 pp. (in Russian). [Романова Е.А., Быбина Р.Т., Голицина Е.Ф., Иванова Г.М., Усова Л.И., Трушникова Л.Г. 1977. Типологическая карта болот Западно-Сибирской равнины. Масштаб 1:2 500 000. Ленинград. 500 с.]

Rudolph, K., F. Firbas & H. Sigmond 1928. Das Koppenplanmoor im Riesengebirge. *Lotos* 76(4/5):173–221.

Ruuhijärvi, R. 1960. Über die regionale Einteilung der nordfinnischen Moore. *Annales Botanici Societatis Zoologicae-Botanicae Fennicae Vanamo* 31(2):1–306.

Rybniček, K. 1974. *Die Vegetation der Moore im südlichen Teil der Bohmisch–Mahrischen Hohe (Vegetace ČSSR, A6)*. Academia, Verlag der Tschechoslowakischen Akademie der Wissenschaften, Praha, 243 pp.

Sekretareva, N.A. 2004. *Vascular plants of the Russian Arctic and adjacent territories*. KMK Press, Moscow, 131 pp. (in Russian). [Секретарева Н.А. 2004. Сосудстые растения Российской Арктики и сопредельных территорий. М.: Товарищество науч. изд. КМК. 129 с.].

Sinelnikova, N.V. 2009. *Classification of plant communities of the Upper Kolyma region (North-East Russia)*. NESC FEB RAS, Magadan, 214 pp. (in Russian). [Синельникова Н.В. 2009. Эколого-флористическая классификация растительных сообществ верховий Колымы. Магадан: СВНЦ ДВО РАН. 214 с.].

Smagin, V.A. 1999a. Vegetation of hollows, ersei and oligotrophic bogs of bogs of the European North of Russia. *Botanicheskii Zhurnal* 84(1):104–164 (in Russian with English summary). [Смагин В.А. 1999. Растительность мочажин, ерсеев и олиготрофных топей болот Европейского севера России // Ботанический журнал. Т. 84, № 1. С. 104–164].

Smagin, V.A. 1999b. Vegetation of mesotrophic swamps, hollows of aapa bogs, erseis of lumpy bogs of northern European Russia. *Botanicheskii Zhurnal* 84(7):80–96 (in Russian). [Смагин В.А. 1999. Растительность мезотрофных топей, мочажин аапа-болот, ерсеев бугристых болот севера европейской России // Ботанический журнал. Т. 84, № 7. С. 80–96].

Smagin, V.A. 2000. On some plant associations of mire vegetation spread in northern part of taiga. *Botanicheskii Zhurnal* 85(10):61–74 (in Russian). [Смагин В.А. 2000. О ряде растительных болот северной тайги // Ботанический журнал. Т. 85, № 10. С. 61–74].

Smagin, V.A. 2003. Mire vegetation in the basin of the Muroyagun River (Surgut Poles'e, West Siberia). *Rastitel'nost' Rossii* 4:62–77 (in Russian). [Растительность болот в бассейне реки Мурояғун (Сургутское Полесье, Западная Сибирь) // Растительность России. № 4. С. 62–77].

Smagin, V.A. 2011. Mire vegetation. In: *The nature of the Sestroretskaya lowland* (E.A. Volkova, G.A. Isachenko & V.N. Khramtsov, eds), pp. 91–115, St. Petersburg (in Russian). [Смагин В.А. 2011. Болотная растительность // Природа Сестрорецкой низины / под ред. Е.А. Волковой, Г.А. Исаченко, В.Н. Храмцова. СПб. С. 91–115].

Smagin, V.A. 2012.Communities with participation of *Carex rostrata* and *Carex lasiocarpa* in the mires of the European Russia boreal zone and their syntaxonomy. *Botanicheskii Zhurnal* 97(6):761–783 (in Russian). [Смагин В.А. 2012. Сообщества с участием *Carex rostrata* и *Carex lasiocarpa* на болотах таежной зоны Европейской России и их синтаксономия // Ботанический журнал. Т. 97, № 6. С. 761–783].

Steffen, H. 1931. Vegetationskunde von Ostpreussen. *Pflanzensoziologie* 1:1–406.

Theurillat, J.-P., W. Willner, F. Fernández-González, H. Bültmann, A. Čarni, D. Gigante, L. Mucina & H. Weber 2021. International code of phytosociological nomenclature. 4th edition. *Applied Vegetation Science* 24(1):1–62.

Tüxen, R. 1937. Die Pflanzengesellschaften Nordwestdeutschlands. *Floristisch-soziologischen Arbeitsgemeinschaft in Niedersachsen* 3:1–170.

Valeeva, E.I., D.V. Moskovchenko & S.P. Aref'ev 2008. Natural complex of Numto Park. Nauka, Novosibirsk, 208 pp. (in Russian). [Валеева Э.И., Московченко Д.В., Арефьев С.П. 2008. Природный комплекс парка "Нумто". Новосибирск: Наука. 280 с.].

Warén, H. 1926. Untersuchungen uber Sphagnumreiche Pflanzengesellschaften der Moore Finnlands. Unter Berueckksichtigung der Soziologischen Bedeutung der einzelnen Arten. *Acta Societatis Fauna et Flora Fennica* 55(8):1–133.

Westhoff, V. & E. van der Maarel 1978. The Braun-Blanquet approach. In: *Classification of plant communities* (R.H. Whittaker, ed.), pp. 287–399, The Hague.

Zelenkevich, N.A., D.G. Grummo, O.V. Sozinov & O.V. Galanina 2016. *Flora and vegetation of the raised bogs of Belarus*. StroyMediaProekt, Minsk, 244 pp. (in Russian). [Зеленкевич Н.А., Груммо Д.Г., Созинов О.В., Галанина О.В. 2016. Флора и растительность верховых болот Беларуси. Минск: СтройМедиаПроект. 244 с.].