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Authors: Pihlaja, Kati, Juutinen, Riikka, Sallantaus, Tapani, Syrjänen, Kimmo, Zielman, Rudi, et al.

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The annual excursion of the Nordic Bryological Society (NBS) and the Finnish Bryophyte Expert Group to Finnish Lapland in 2019

Kati Pihlaja, Riikka Juutinen, Tapani Sallantaus, Kimmo Syrjänen, Rudi Zielman, Michael Lüth, Esa Ervasti, Tuomo Kuitunen, Kristian Hassel, Kjell Ivar Flatberg, Richard Åkesson, Eva Mikulášková, Pia Kangas and Antje Neumann

K. Pihlaja ✉ (kmpihl@utu.fi), Herbarium, Biodiversity Unit, Univ. of Turku, Finland. – R. Juutinen, Centre for Economic Development, Transport and the Environment in Lapland, Rovaniemi, Finland. – T. Sallantaus and K. Syrjänen, Finnish Environment Inst., Helsinki, Finland. – R. Zielman, Enschede, the Netherlands. – M. Lüth, Freiburg, Germany. – E. Ervasti, Raasepori, Finland. – T. Kuitunen, Jyväskylä, Finland. – K. Hassel and K. I. Flatberg, Dept of Natural History, NTNU Univ. Museum, Norwegian Univ. of Science and Technology, Trondheim, Norway. – R. Åkesson, Höganäs, Sweden. – E. Mikulášková, Dept of Botany and Zoology, Masaryk Univ., Brno, Czech Republic. – P. Kangas, Pyhätunturi, Finland. – A. Neumann, Oulu, Finland.

The Nordic Bryological Society held its Annual meeting and excursion from 5 to 9 August 2019 in Sodankylä, Kittilä and Kolari in northern Finland. The excursion was attended by twenty-one participants. Special emphasis was given to boreal aapa mires and their *Sphagnum* species. A multitude of *Sphagnum* species typical to the area was encountered. Also, Red Listed species of meso- and eutrophic flark fens were discovered, e.g. *Hamatocaulis vernicosus*, *H. lapponicus*, *Meesia longiseta*, *Schistochilopsis grandiretis* and *Moerckia flotoviana. Sphagnum annulatum*, *S. flexuosum*, *S. divinum*, *Heterogemma laxa* and *Scapania umbrosa* were collected for the first time from Kittilän Lappi biogeographical province. *Sphagnum annulatum*, *S. divinum*, *Campylium laxifolium*, *Pohlia sphagnicola*, *Gymnocolea borealis* and *Heterogemma laxa* were collected for the first time from Sompion Lappi biogeographical province. In total, 54 records of Red Listed species were made.

Keywords: excursion, Finland, Lapland, Nordic Bryological Society, Sphagnum, aapa mire

The Nordic Bryological Society (NBS) held its Annual meeting and excursion from 5 to 9 August 2019 in Sodankylä (Sompion Lappi, SoL), Kittilä and Kolari (Kittilän Lappi, KiL) in northern Finland. From 1966 to 2018 the yearly NBS excursions have been in Finland altogether nine times, the last one five years ago in Kuusamo, northeast Finland (Juutinen et al. 2016). The number of participants in the 2019 excursion totalled to twenty-one, including citizens of seven countries: Finland (12), Sweden (1), Norway (2), Denmark (2), the Netherlands (2), Germany (1) and the Czech Republic (1) (Fig. 1).

The bryophyte flora of central Finnish Lapland is extremely well surveyed in some parts but poorly studied in others. Botanists from Metsähallitus Parks and Wildlife (the Finnish Forest Administration) and various consultant biologists have made inventories of Red Listed bryophytes especially during the past 10 years.

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Central Finnish Lapland is characterized by a cool and humid climate, which together with a fairly flat terrain has led to the development of vast aapa mires. The terrain is mostly 200–300 m a.s.l., ranging from 160 m a.s.l. in the river valleys to 400–500 m a.s.l. in hill and mountain areas. Some mountains in the Pallas-Ylläs National Park reach up to 800 m a.s.l. Most of the land in central Lapland is state owned and scarcely populated with less than 1 resident per km^2 (Statistics Finland 2019). Figure 2 shows a map of central Lapland and the location of our field sites.

The bedrock in central Lapland is of particular interest. There is a greenstone belt, i.e. schist area, which is characterized by volcanic and sedimentary rocks (Saverikko 1987). The area has attracted the interest of several mining exploration companies which have claimed large areas especially in the northern parts of Sodankylä and Kittilä municipalities. Exploration activities are carried out also within nature conservation areas. We concentrated our inventories mainly to proposed nature conservation areas that have mining exploration permits but scarce data of species occurrences.

Altogether, 348 species of mosses and 130 species of liverworts are known to occur in the biogeographical province of Kittilän Lappi, and 327 species of mosses and 122 species of

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Figure 1. The participants of the excursion. Ylläs, Kolari. Missing from the picture: Laura Vuoksenmaa. Photo: Michael Lüth.

liverworts in Sompion Lappi (Juutinen and Ulvinen 2018). This is about 50% of all bryophyte species in Finland. During the excursion, we had a special emphasis on *Sphagnum* species.

The IUCN Red List status follows Juutinen et al. (2019) at the national level and Sammaltyöryhmä (2017) at the regional level. The Red List status is given when a species is mentioned for the first time (EN endangered, VU vulnerable, NT near threatened, DD data deficient, RT regionally threatened). The scientific names follow Hodgetts et al. (2020). All observations presented here were made by the authors. All specimens deposited to Finnish herbaria can be checked through the Finnish Biodiversity Info Facility (<https://laji.fi/en/observation/map>).

Monday 5 August

The first location of the excursion was Viiankiaapa in Sodankylä. Viiankiaapa is a mire protection area and part of the Natura 2000 network. Viiankiaapa consists of a large aapa mire system, which is characterized by vast meso- and eutrophic flark fens and rich occurrences of threatened bryophytes. Viiankiaapa has probably the largest known occurrences of *Hamatocaulis vernicosus* (NT, Habitats directive annex II) and *Meesia longiseta* (EN, Habitats directive annex II) in Finland. Also, the largest known occurrences of *Hamatocaulis lapponicus* (VU, Habitats directive annex II) in Lapland are situated within the area. Some parts of the Viiankiaapa mire protection area have been studied very well during the last 10 years by consultant biologists contracted by the company AA Sakatti Mining that is planning to build an underground mine there, but large areas that are difficult to access still remain less known.

We split into three groups: the first group followed the nature trail near Lake Viiankijärvi, the second group had a special interest in *Hamatocaulis lapponicus* and headed to Sakattilammit, and the third group intended to see *Meesia longiseta* southwest of Kiimakuusikko.

Around Lake Viiankijärvi the peatmoss flora was quite diverse with more than 20 species, including *Sphagnum annulatum* and *S. divinum* (both new to SoL province), *S. aongstroemii*, *S. balticum*, *S. contortum* and *S. brevifolium*. A small patch of *Pohlia sphagnicola* (VU, new to SoL) was observed growing on a hummock together with *Mylia anomala*. The shoots were without sex organs so the determination was based on the smaller leaf cells compared to the commonly observed *P. nutans*. In the base rich part, *Hamatocaulis vernicosus* dominated, growing together with *Paludella squarrosa*, *Cinclidium stygium* and *C. subrotundum*. In the mire margin we found a nice stand of *Polytrichum swartzii* growing together with *P. commune. Odontoschisma fluitans*, which had not been reliably recorded from the SoL province since 1940, was observed and collected.

The *lapponicus* group headed towards Sakattilammit. *Hamatocaulis lapponicus* is restricted to aapa mires in the north, and is rare or absent from Europe outside Russia (Fig. 3).

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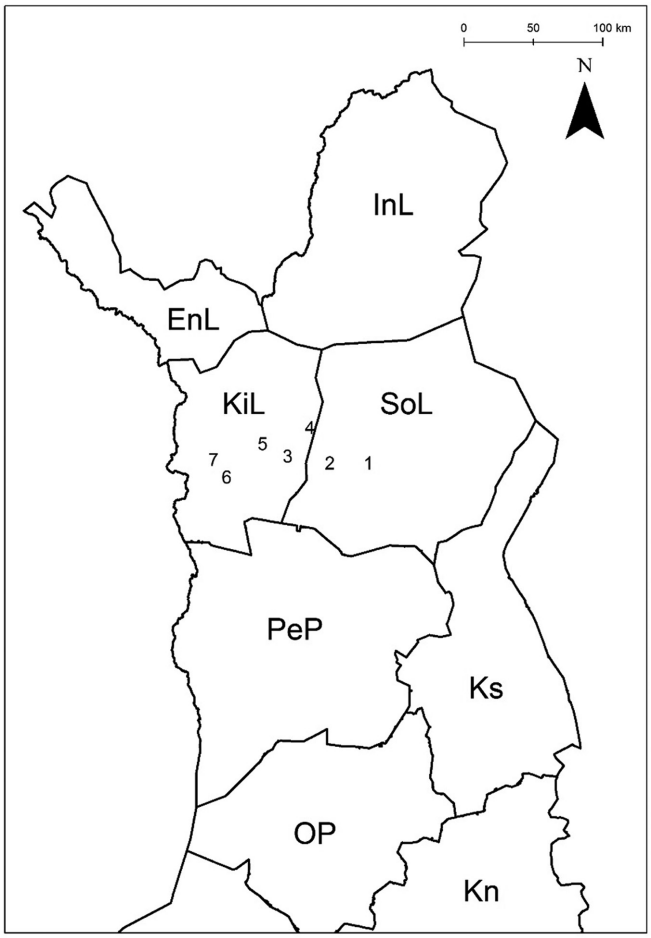


Figure 2. The field sites of the excursion and Finnish biogeographical provinces. 1 = Viiankiaapa, 2 = Kaarevuoma, 3 = Taljavaara, 4 = Pitsloma, 5 = Pahkavuoma, 6 = Tuulijoki, 7 = Pikkulaenoja and Kuerlinkat.



Figure 3. *Hamatocaulis lapponicus* in Viiankiaapa, Sodankylä. Photo: Michael Lüth.

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Its habitats are typically very wet and difficult to traverse. After two very dry summers the area was relatively accessible and all of us eventually reached the wobbly swamp fen shore of one of the ponds in Sakattilammit (=Sakatti ponds) area. *Sarmentypnum procerum* is common in the area, together with *Sarmentypnum exannulatum* and *S. tundrae*. *Hamatocaulis lapponicus* was detected as few individual shoots in the pond margin. This type of habitat is typical for *H. lapponicus* in southern Finland, in the water, but attached to the floating fen margin of a near neutral-water pond or small lake. It may also grow submerged.

North of the pond we finally found a somewhat dried up flark in a rich birch fen where *H. lapponicus* was dominant in an area of about 100–200 m^2 in size. This is a large occurrence among the about 30 separate patches within 0.5 km from this patch, and in comparison to the about 50 separate occurrences outside Viiankiaapa in the rest of Finland. The dry summer had induced a reddish colour to the shoot tips. During a wet growing season, the shoots are a bright green colour.

Hamatocaulis lapponicus is less demanding for calcium (Ca) than *H. vernicosus* (Ruuhijärvi 1962). The calcium content in Sakatti ponds in the growing season is quite low with a median of 2.8 mg l^{-1}, but it is enough to keep the water neutral (median pH 7) thanks to the low total organic carbon (TOC) (6 mg l^{-1}) and the absence of sulfate (less than 0.2 mg l^{-1}). The iron content is moderate (0.7 mg l^{-1}), with aluminium, and potassium below detection limit (AA Sakatti Mining Oy 2021). These values do not indicate fresh ground-water influence and do not give easy interpretations for the specific water quality demands of *H. lapponicus*, a moss very fond of water.

Southwest of Kiimakuusikko there are many known occurrences of *Meesia longiseta*, *Hamatocaulis vernicosus*, *Moerckia flotoviana* (NT) and *Schistochilopsis grandiretis* (EN). The area has mostly pine bogs and eutrophic pine fens with some wet depressions. We found small patches of these four species scattered here and there. In addition to these we noted *Tayloria lingulata*.

Tuesday 6 August

On the second day of our excursion, we divided into two groups: one group headed to Kaarevuoma in Sodankylä and the other one to Taljavaara in Kittilä.

Kaarevuoma is an aapa mire located on the southern side of the hill Kaarestunturi, which is about 390 m high. Kaarevuoma has a nature protection area established in 2017 and active mining exploration permits exist, but there was no previous data on species occurrences.

We started our tour on the eastern part of Kaarevuoma outside the nature protection area. Here we found abundant *Brachythecium rivulare*, *Pseudobryum cinclidioides*, and the vascular plants *Epilobium hornemannii* and *Chrysosplenium tetrandrum* growing in a large mesotrophic spring. When heading west towards a small brook, Tuohenkiskomaoja, and crossing it, the area consisted mostly of eutrophic flark fens and eutrophic pine fens with abundant *Sphagnum teres*, *S. platyphyllum*, *S. subsecundum*, *S. warnstorfii*, *Sarmentypnum procerum*, *S. sarmentosum* and *Scorpidium scorpioides.* Scattered here and there we found *Scapania hyperborea*, *Cinclidium subrotundum*, *Dicranum angustum* and *Meesia triquetra*. *Heterogemma laxa* (new to SoL) was found growing on *Sphagnum fuscum* dominated hummocks in the rich fen. We also found a small stand of *Gymnocolea borealis* (DD, new to SoL) in the rich fen growing intermixed as single shoots among *Sphagnum warnstorfii* and *Straminergon stramineum*. In addition, *Loeskypnum badium* and *Scapania paludicola* were seen. We discovered the extremely rare *Campylium laxifolium* (EN), which has only three current localities in Finland. We also had the chance to examine scattered patches of *Sphagnum annulatum*. Heading back to our cars at the end of the day, we discovered the first occurrence of *Meesia longiseta* for Kaarevuoma, with multiple capsules.

Taljavaara is a rich fen area located between Sodankylä and Kittilä. It is in the process of being established as a nature conservation area. The bedrock of the area is gabbro and arkose quartzite with some occurrences of mafic rocks (<https://gtkdata.gtk.fi/Maankamara>). The area has been visited in the 1990s by Tauno Ulvinen and some occurrences of *Drepanocladus lycopodioides* (VU), *Hamatocaulis vernicosus* and *Saxifraga hirculus* (VU) were known before our visit. We divided into smaller groups and saw numerous *Cratoneuron* springs with *Cratoneuron filicinum* (NT), *Palustriella falcata* (NT), *P. decipiens* (NT) and *Saxifraga hirculus*. *Drepanocladus lycopodioides* was refound close to the bridge across the river Ala-Kuusanjoki. There, in a rich pine fen grew also *Meesia longiseta*, *M. triquetra* (with lots of long setas), *Tayloria lingulata* and *Hamatocaulis vernicosus*. Some parts of the area are more nutrient poor with pine mires or pine bogs.

Taljavaara hill is about 260 m high with boulders and terraces of serpentinite rocks around the hilltop. Most of the rock surfaces were quite bare but *Pseudoleskeella papillosa* (VU) was found at several sites, accompanied by *Radula complanata*, *Eurhynchiastrum pulchellum*, *Pterigynandrum filiforme*, *Sphenolobus minutus*, *Metzgeria furcata* and the lichen *Protopannaria pezizoides* (NT). The view from the hilltop over the wilderness of Tolloaapa mire towards Levi fell was spectacular. The northern slope of Taljavaara is covered by old-growth forest. On some decaying spruce and pine logs we found *Crossocalyx hellerianus* (VU) and *Lophozia guttulata* (VU), and on one fallen birch dense tufts of *Dicranum fragilifolium* were growing.

In the evening, we set up our microscopes in a meeting room at the hotel to examine our discoveries in detail.

Wednesday 7 August

On the third day, we all headed to Pitsloma northeast of Kittilä centre. Pitsloma is a diverse nature conservation area with low calcareous cliffs, a string of calcareous spring ponds in a ravine, springs, aapa mires and old-growth forests.

In the eastern part of the area the waters flow towards southeast. On calcareous cliffs near Pitslomajärvet we found *Encalypta procera* (NT), *E. brevicolla*, *Cnestrum schisti*, *Gymnostomum aeruginosum* (NT), *Pseudoleskeella papillosa* and *Porella platyphylla* (EN). Near a pond in the ravine grew large patches of *Brachythecium turgidum* (RT). *Cratoneuron filicinum* and *Palustriella decipiens* were seen in some springs. The peculiar looks of *Sphagnum warnstorfii* aroused discussion.

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For some the sight of *Tetraplodon angustatus* on a moss covered bone was amazing. Also, finding the diocious *Meesia triquetra* with sporophytes was a nice experience for some of us!

In the western part of the area are the headwaters of river Loukinen, which flows northwest and starts its journey as a small brook in a mire. Here we found some springs with *Palustriella decipiens* and *Calliergon giganteum*.

Near Sattasketo northeast of Pitsloma we checked a known occurrence of the vascular plant *Moehringia lateriflora* (NT) growing in a meadow. A nearby riverside forest showed plenty of *Dichelyma falcatum* with sporophytes on twigs just above the mud. In this occasionally flooded mixed forest we found a rather rich composition of old-growth forest liverworts on one large decaying spruce log. The species included e.g. *Lophozia ascendens* (EN), *Lophozia ciliata* (EN), *Lophozia guttulata*, *Crossocalyx hellerianus*, *Tritomaria exsectiformis* (NT) and *Schljakovia kunzeana*.

After a rainy day in the field we gathered in the evening for the annual meeting of the NBS and after that – some more microscoping!

Thursday 8 August

On the fourth day we split into two groups again: one group headed to Pahkavuoma near the centre of Kittilä and the other group to Tuulijoki near the border of Kittilä and Kolari communes.

Pahkavuoma is a large aapa mire, which has only a few ditches along the edges and is divided in the middle by the main road. At the moment, it is unprotected and has mining exploration permits. There is one old and inaccurate observation of *Hamatocaulis lapponicus* in the central part of the mire from the 1950s, but it was not found this time.

We explored parts of the northern half, on the southwestern side of Pahkavaara hill. We encountered mostly mesotrophic sedge fens with abundant *Sphagnum lindbergii*, *S. fuscum*, *S. angustifolium*, *S. jensenii*, *S. papillosum*, *S. teres*, *Sarmentypnum procerum*, *S. sarmentosum*, *Dicranum undulatum*, *Straminergon stramineum*, *Mylia anomala* and *Scapania paludicola*.

Along the whole western edge of the Pahkavaara hill, groundwater flows out to the mire, which is clearly visible also on aerial photographs. The springs were mostly mesotrophic with a local eutrophic effect. Common species along the springs were *Sphagnum fallax*, *Helodium blandowii*, *Tomentypnum nitens*, *Sarmentypnum exannulatum*, *Paludella squarrosa*, *Rhizomnium pseudopunctatum*, *Calliergon giganteum*, *Aulacomnium palustre* and the vascular plants *Neottia cordata* and *Tofieldia pusilla*.

The mires along Pahkavaara were rather species poor and our group decided to visit the nearby Levi fell. Levi is 531 m high with a bare summit covered by scree and small areas of alpine heath. Levi is a popular skiing resort and most of the fell top has been altered by human activities. However, we found some typical fell bryophytes, including *Polytrichum hyperboreum* and *Oligotrichun hercynicum*. At the southern base of the fell we paused at a spring-fen close to the road with *Saxifraga hirculus*, *Carex appropinquata* (VU) and *Hamatocaulis vernicosus*. The shoreline of the naturally eutrophic Immenlompolo-lake harboured abundant stands of *Stratiotes aloides* and *Calliergon megalophyllum*.

Tuulijoki is a mostly oligo-mesotrophic mire area that is in the process of being established as a nature conservation area (Fig. 4). A northwest-southeast ridge runs across the mire, and locals use it as a recreational area. We started from the southern part of the mire (Lehmäkaltionvuoma mire; lehmä = cow, kaltio = spring, vuoma = mire), which was mostly oligotrophic with several abundantly flowing mesoeutrophic springs. For people of the south, the combination of Sphagna there seemed unusual, for instance, *Sphagnum majus* var. *norvegicum*, *S. annulatum*, *S. balticum*, *S. angustifolium* and *S. fuscum* were growing intermixed.



Figure 4. Tuulijoki mires, Kittilä. Photo: Esa Ervasti.

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Figure 5. *Sphagnum annulatum* in Tuulijoki mires, Kittilä. Photo: Michael Lüth.

We had lunch close to a meso-eutrophic spring in Lehmäkaltionvuoma. The species we found in the spring and its creek were *Pohlia wahlenbergii*, *Bryum weigelii*, *Warnstorfia exannulata* and *Philonotis seriata*. We also found patches of *Sphagnum teres* near the spring.

After lunch we continued to explore the northern side of the ridge where we encountered… a rich fen! After having seen quite a few during the past few days, this did not spark that much interest anymore. *Meesia longiseta* and *Moerckia flotoviana* were discovered as new to the area. Further on, the mire became more *Sphagnum* dominated and we recorded *Sphagnum subsecundum*, *S. platyphyllum*, *S. papillosum*, *S. compactum*, *S. annulatum*, *S. angustifolium*, *S. fallax*, *S. riparium*, *S. russowii*, the same odd *S. warnstorfii*, *S. obtusum*, *S. lindbergii*, *S. aongstroemii* and *S. subfulvum*. *Sphagnum flexuosum*, *S. annulatum* (Fig. 5) and *Heterogemma laxa* were recorded as new to the the KiL province. The different appearances of *Sphagnum divinum* were inspected – when growing on top of a hummock *S. divinum* tends to show a more compact habit with less slender pointed branches, resembling *S. medium*. *Scapania umbrosa* was found on a decaying log in the transition from mire to forest. The discussion on differences between *Sphagnum* species was further continued in the evening.

Friday 9 August

The last day of our excursion was spent in Kolari, first at the southern slope of Ylläs fell at Pikkulaenoja, a proposed nature conservation area, and then at Kuerlinkat rapids along river Kuerjoki.

Pikkulaenoja consists of eutrophic paludified hardwood forest with giant spruces *Picea abies* and partly underground streams. Common vascular plants were e.g. *Athyrium filix-femina*, *Caltha palustris*, *Cornus suecica* and *Lactuca alpina.* Here we encountered the first *Sphagnum girgensohnii* of the excursion and also *Sphagnum russowii*, *S. angustifolium*, *S. riparium* and *S. squarrosum. Scapania paludosa* (VU) was growing on the moist forest floor. Other species common on the forest floor were *Bryum weigelii*, *Rhytidiadelphus triquetrus*, *R. subpinnatus*, *Rhizomnium magnifolium*, *Plagiomnium medium*, *Pseudobryum cinclioides*, *Brachythecium salebrosum*, *Hylocomiastrum umbratum* and *H. pyrenaicum*. Growing on stones in the brook we found *Harpanthus flotovianus* and *Rhynchostegium riparioides* (NT).

Kuerlinkat are rapids with steep cliffs on both sides of the river. The bedrock is mostly quartzite with some biotite paragneiss nearby (<https://gtkdata.gtk.fi/Maankamara>). On the cliffs we found a nice composition of rock inhabiting species like *Cynodontioum strumiferum*, *C. tenellum*, *Grimmia torquata* and especially *Cnestrum alpestre* (not seen in the province KiL since 1940), *C. schisti* and *Ulota curvifolia*. Growing on river stones we found *Fontinalis antipyretica*, *F. dalecarlica*, *Hygrohypnum ochraceum*, *H. duriusculum* and *Rhyncostegium riparioides*. On the way back to the cars KIF and KH demonstrated the variation within *Sphagnum teres*.

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References

AA Sakatti Mining Oy 2021. Sakatin monimetalliesiintymän kaivoshanke, Ympäristövaikutusten arviointiselostus. Liite 17: pohja-ja pintavesien tarkkailutulokset. Environmental impact assessment of Sakatti, appendix 17, in Finnish, cited 3 Feb 2021. <www.ymparisto.fi/fi-fi/Asiointi_luvat_ja_ymparistovaikutusten_arviointi/Ymparistovaikutusten_arviointi/YVAhankkeet/Sakatin_monimetalliesiintyman_kaivoshanke_Sodankyla>.

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Hodgetts, N. G., Söderström, L., Blockeel, T. L. et al. 2020. An annotated checklist of bryophytes of Europe, Macaronesia and Cyprus. – J. Bryol. 42: 1–116.

Juutinen, R. and Ulvinen, T. 2018. Suomen sammalien levinneisyys eliömaakunnissa. – Suomen ympäristökeskus, 29 Nov 2018. <www.ymparisto.fi/fi-FI/Luonto/Lajit/Lajiensuojelutyo/Eliotyoryhmat/Sammaltyoryhma/Suomen_sammalet>.

Juutinen, R., Åkesson, R., Syrjänen, K. et al. 2016. The annual excursion of the Nordic Bryological Society (NBS) and the Finnish Bryophyte Expert Group to Kuusamo (Finland) in 2014. – Lindbergia 39: 20–23.

Juutinen, R., Syrjänen, K., Korvenpää, T. et al. 2019. Bryophytes. – In: Hyvärinen, E., Juslén, A., Kemppainen, E. et al. (eds), The 2019 Red List of Finnish species. Ministry of the Environment & Finnish Environment Inst., pp. 157–181.

Ruuhijärvi, R. 1962. *Drepanocladus lapponicus* (Norrl.) Z. Smirn. in Finnland. – Arch. Soc. Zool. Bot. Fenn. Vanamo 17: 218–227.

Sammaltyöryhmä 2017. Suomen sammalien levinneisyys metsäkasvillisuusvyöhykkeissä ja ELY-keskuksissa. – Suomen ympäristökeskus, 3 Jan 2017. <www.ymparisto.fi/fi-FI/Luonto/Lajit/Lajiensuojelutyo/Eliotyoryhmat/Sammaltyoryhma/Suomen_sammalet>.

Saverikko, M. 1987. The Lapland greenstone belt: stratigraphic and depositional features in northern Finland. – Bull. Geol. Soc. Finland 59: 129–154.

Statistics Finland 2019. Key figures on population by region, 1990–2018, 19.6.2019. – Statistics Finland, cited 12 Nov 2019. <http://pxnet2.stat.fi/PXWeb/pxweb/en/StatFin/StatFin__vrm__vamuu/statfin_vamuu_pxt_11lj.px/>.

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