# BOTANICAL EXCURSIONS ON THE NORTHERN SØRØYA

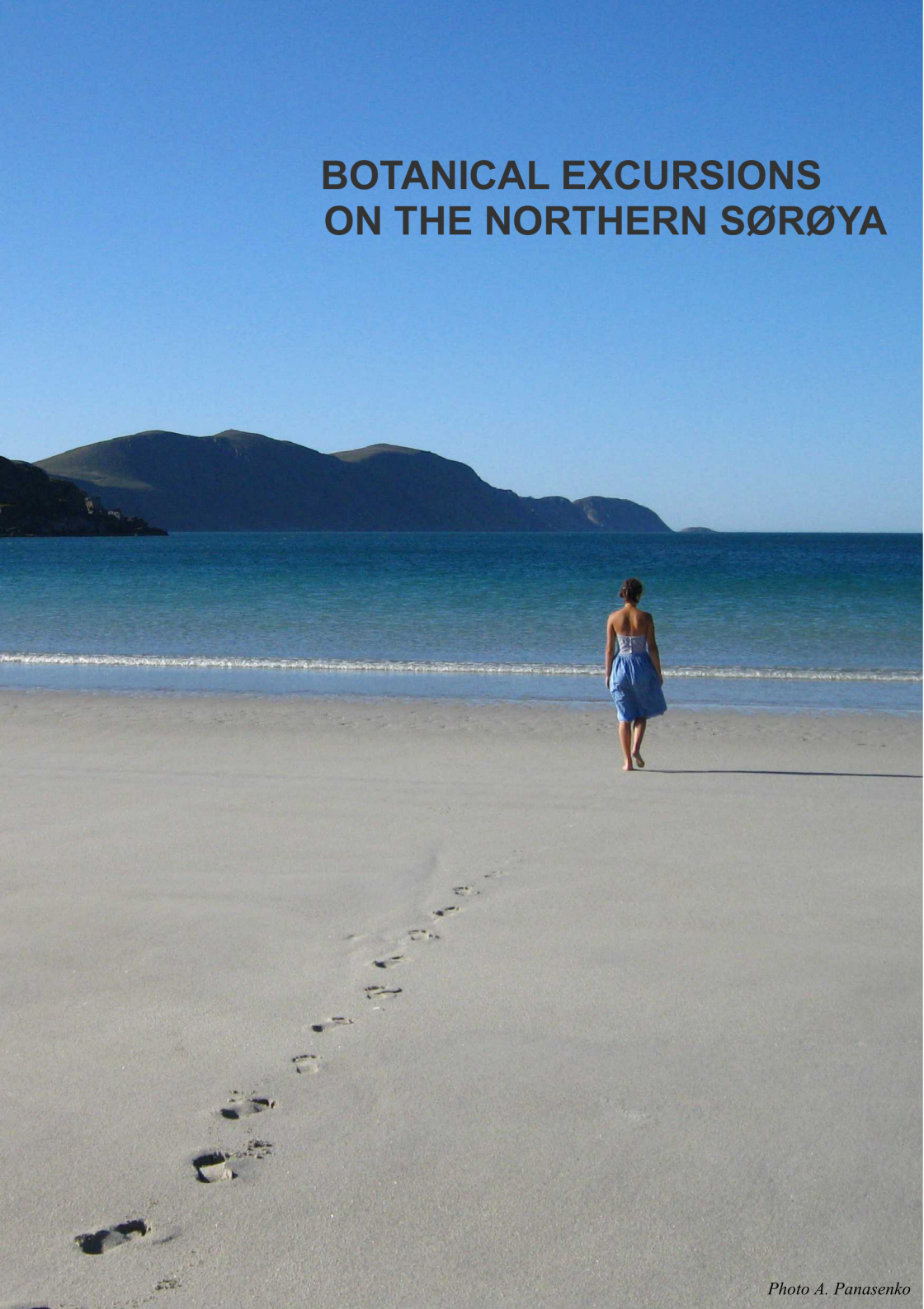
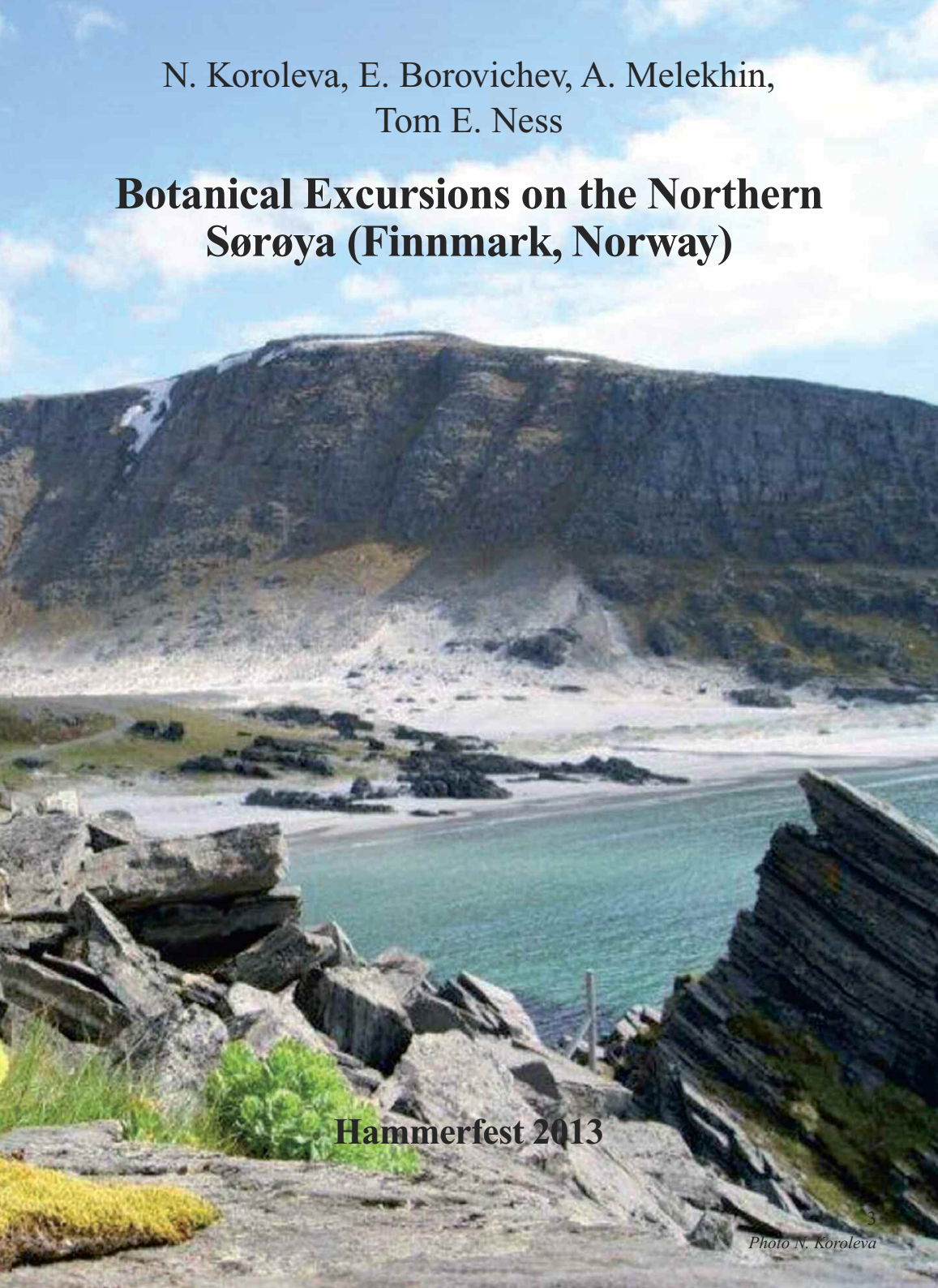


*Photo A. Panasenko*

N. Koroleva, E. Borovichev, A. Melekhin,
Tom E. Ness

# Botanical Excursions on the Northern Sørøya (Finnmark, Norway)



Hammerfest 2013

*Photo N. Koroleva*

Koroleva, N., Borovichev, E., Melekhin, A., Ness, Tom E. Botanical Excursions on the Northern Sørøya (Finnmark, Norway). Hammerfest, 2013.

The aim of this guide-book is to illustrate the main vegetation types, plants and lichens of the northern part of Sørøya, the fourth largest island of Norway and to allow visitors to become acquainted with its beautiful and fragile natural environment. The guide contains more than 230 full-colored photographs, the plants are arranged according to their habitats, and mosses and lichens are covered in their own chapters. A good companion for all who are interested in northern wildlife.

Reviewers: Dr. M. Dodd, Dr. I. Tatarenko, Dr. A. Sortland, E. Tatarenko.

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THE NORWEGIAN BARENTS SECRETARIAT

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**Institute after N.A. Avrorin of Kola Science Center**
**of Russian Academy of Science**
**Murmansk Branch of Russian Botanical Society**

N. Koroleva, E. Borovichev, A. Melekhin, Tom E. Ness

# Botanical Excursions on the Northern Sørøya (Finnmark, Norway)

*Cloudberry (Rubus chamaemorus) – the province plant of Finnmark*
*Photo N. Koroleva*

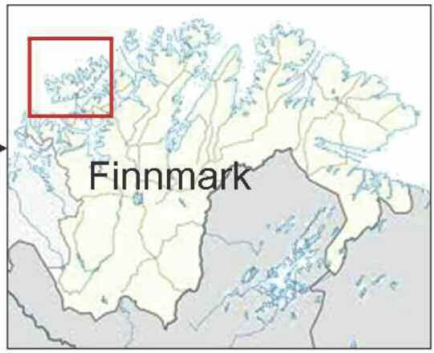
Hammerfest
2013

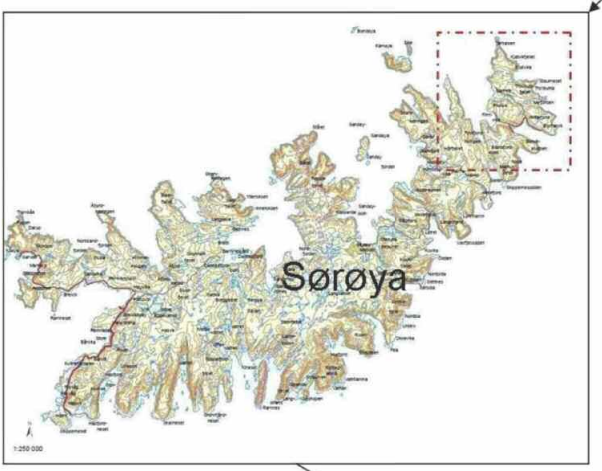
*We do not accept any authority in botany*
*but observation with one's own eyes.*

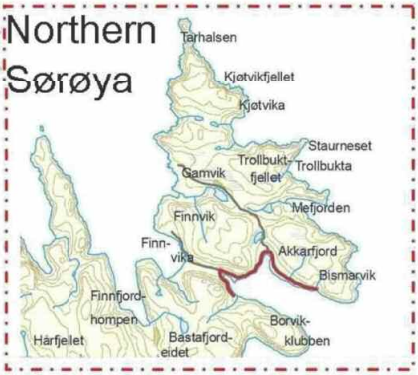
Carl Linnaeus, Genera plantarum, Ratio operis

*Photo E. Ness*


Norwegian Sea
Barents Sea
ICELAND
Faeroe Islands
Atlantic Ocean
Shetland Islands
NORWAY
SWEDEN
FINLAND
RUSSIA
North Sea
DENMARK
LAT.
LITH.
BELARUS
IRELAND
U.K.
GERMANY
POLAND
UKRAINE
FRANCE


Finnmark


Sørøya


Northern Sørøya
Tarhalsen
Kjøtvikfjellet
Kjøtvika
Staurneset
Trollbukt-fjellet
Trollbukta
Gamvik
Finnvik
Mefjorden
Finn-vika
Akkarfjord
Bismarvik
Finnfjord-hompen
Borvik-klubben
Bastafjord-eidet
Hårfjelet

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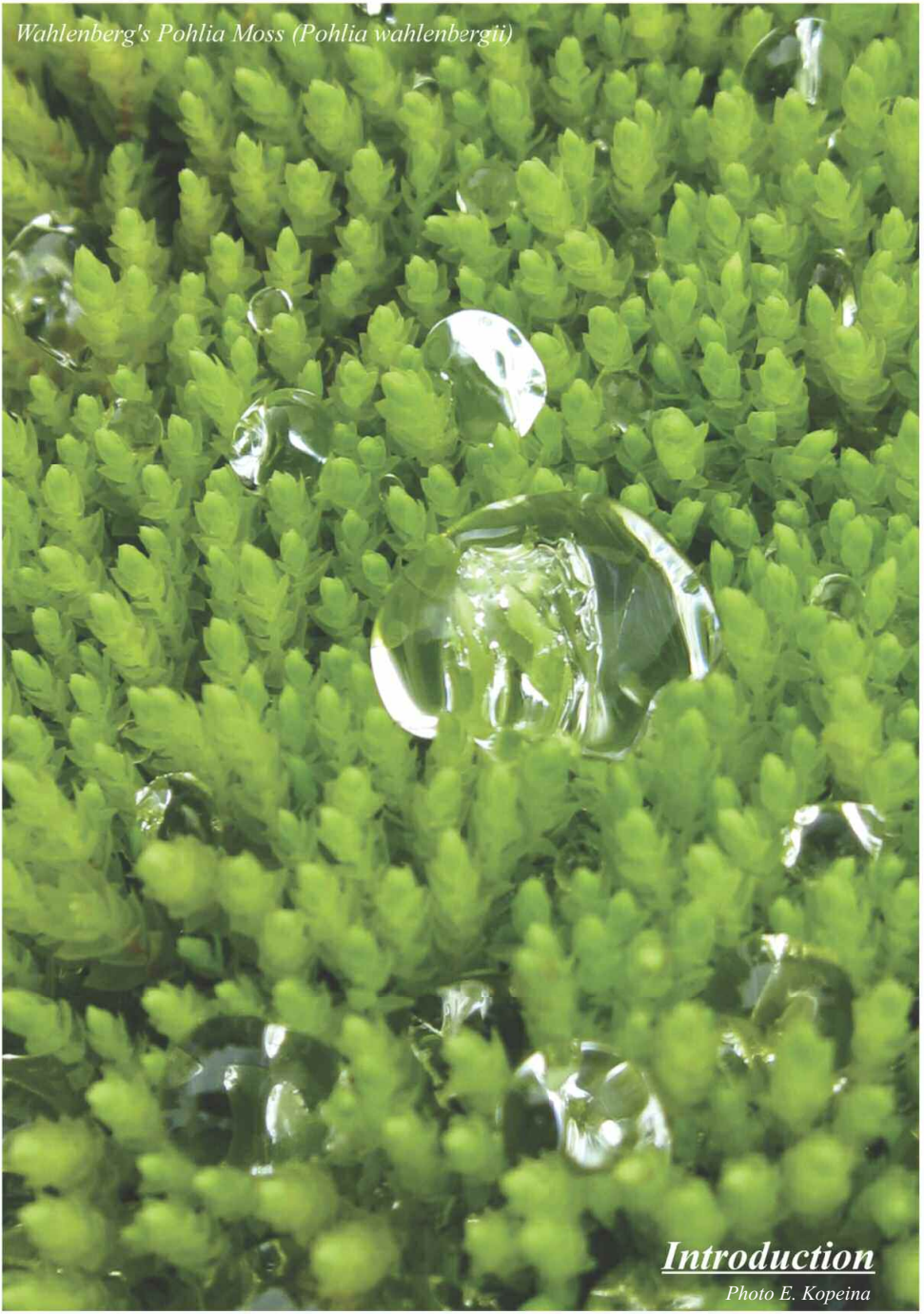

Wahlenberg's Pohlia Moss (Pohlia wahlenbergii)
Introduction
Photo E. Kopeina


*Photo N. Koroleva*

# Introduction

The cooperation project "Botanical Excursions on the Sørøya Island" was initiated in 2011 by the ecologists of Hammerfest Kommune (Northern Norway) and scientists of Polar-Alpine Botanical Garden-Institute (Kirovsk, Russia). Project's purpose is to illustrate major vegetation types and the most common plants of the northern part of the Sørøya Island, one of the largest islands of northern Finnmark.

Norway does considerable amount to encourage the interests in both nature conservation and outdoor recreation. People enjoy a diverse range of holidays in the area, adventure tourism, ecotourism as well as general sightseeing by students and families. The appreciation of the fragile world of wild nature motivates people to contribute to the protection of the area. Educational tourism itself and as a part of sightseeing, sportive, family, students, etc. and other types of tourism motivates people by the desire to learn and enjoy the environment, gets people accustomed to the fragile world of wild nature and can considerably contribute to its protection.

Being an important part of terrestrial biodiversity, plants represent the most peculiar and loveliest of its components. In response to the growing interest in the Sørøya Island plant life, this guide-book helps to identify the most common and distinguished vegetation types as well as most prominent and interesting wildflowers, mosses and lichens. The book doesn't substitute the excellent guide-books, manuals and lists of plants, lichens and vegetation types of Norway and other Scandinavian countries, which are of great help for people interested in natural history and ecotourism in the North.

We hope that the book would add to better understanding and intense delight of magnificent nature of the Sørøya Island, the largest emerald in the crown of the northern Norway.

Our sincere thanks to editors of this guide-book, especially Andy Sortland, Tromsø University, Michael Dodd and Irina Tatarenko, The Open University, for inspiring discussion and good advices. Warmest acknowledgements to Tom Eric and Elena Ness, for enabling us to visit Sørøya Island and for indispensable support of this book.

***Features of land and climate***

*Photo F. Neregård*


*The richly indented coastline of the northern Sørøya includes hard cliffs with narrow strips of sand below them in the more shallow bays*

## Features of land and climate


*The sedimentary rocks were folded during Caledonian orogeny and then uplifted, broken and eroded*

The Sørøya is situated 15 km west of Hammerfest, and divided between two municipalities in Finnmark county – Hammerfest and Hasvik. This is the fourth largest island in Norway, with a surface area of 812 km$^2$. It belongs to Fennoscandia, a physic-geographical area which includes Norway, Sweden, Finland and northwestern Russia (Kola Peninsula and Karelia). Fennoscandia is characterized by very ancient bedrocks. Near the middle of the Paleozoic era western Fennoscandia rose and was folded during the Caledonian orogeny and uplifted in the late Tertiary forming a part of the Caledonia range.


*Though the Scandes descend gradually to the north, true alpine forms with sharply rugged ridges and peaks are not rare on the Sørøya*

Photo N. Koroleva

Photo N. Koroleva

*During the ice ages glacial erosion resulted in wide valleys, where numerous lakes occurred*

The Sørøya Island lies on the northernmost part of Caledonian mountain range of Scandes, where the Cambro-Silurian sedimentary rocks (mainly metamorphized shists) prevail. There are also areas of Caledonian gabbro and Precambrian sandstone conglomerates on the island.

General relief of the island is sharply rugged. The highest point of the island, mountain Komagaksla (659 m high), is found in the central part, while most of the Sørøya doesn't exceed 300-400 m high. Long wide valleys open directly to the Sea, and together with numerous rivers and ravines, which divide the plateau-like mountain range, add to the brokenness of landscape.

The whole territory was covered by glacier during the Pleistocene epoch. The ancient ice shield and glacial lakes and rivers dramatically transformed the island surface and resulted in glacial relief (cirques, and U-shaped valleys in mountains) and extensive moraine deposits,

Photo N. Koroleva

*Outwashed marine sand blown by storm winds on the Sandfjellet mountain slope*


*Sea exposed cliffs on the way to Kjøttvikvarden*

mainly marginal moraines.

In the Holocene, after glacial retreat, water levels dropped significantly, and as a result of land uplift and sea abrasion, distinctive terraces were formed in coastal areas and rivers mouths. They are mainly composed of raised marine sand and pebbles. In some areas stormy winter winds form extensive fine-grained aeolian sand deposits on windward and sea-exposed terraces and mountain slopes.


*The narrow strip of sand was previously at the bottom of a sea inlet, and after land uplift and sea retreat the wind blow marine sand to the mountain slope*

Due to steep rocky relief of the coastline, strandflats are developed only in some shallow bays, and true cliffs predominate over coasts of the whole island. The flat sandy beaches are the most spectacular and attractive landscapes of the Sørøya Island. A huge mass of outwashed marine sand was shifted by wind along the sea exposed slope of Sandfjellet Mountain.

In winter as well as in summer, the climate of the Sørøya and the whole of the northern Norwegian coastal


*Aeolian sandy dune of Sandfjellet mountain slope*

area has only a slight difference between south and north. Winters on the Sørøya are remarkably mild for its high latitude, and summers are rather cool. Precipitation is quite high. Snow lies until June. In winter it is unevenly distributed due to rugged topography, and there are great differences between mountain summits and valleys. The climatic differences between the coast and inland, lowlands and summits are sometimes more dramatic than along south-to-north gradient. Changes in microclimate and topography determine the most important ecological gradient influencing vegetation.

During two months, from 21 November till 21 January, the north of the Sørøya experiences a period of polar night, when the sun is completely below the horizon. Actually at midday there may still be some light owing to light scattering by the upper atmosphere and refraction. There is polar twilight instead of polar night, which may be darker because of the cover of dense clouds.

Sunlight may be visible because of refraction. There can even be the impression that the sun is rising earlier than it astronomically


*The coastal area is fogged on numerous days during the year*

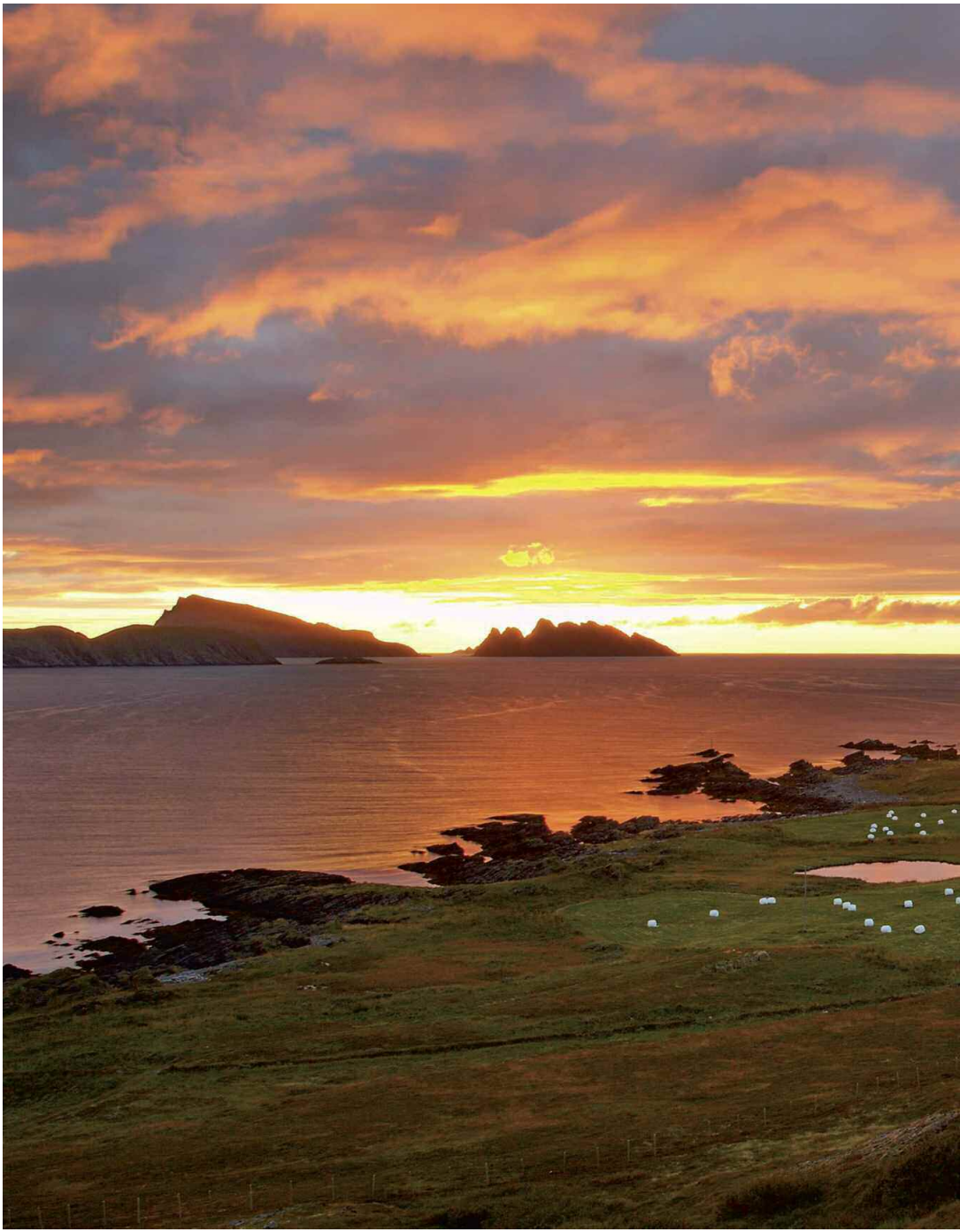
should. This polar mirage ("the Novaya Zemlya effect") is caused by multiplied sunlight refraction when huge layers of atmosphere near the earth act like lenses.

The opposite phenomenon, the polar day, or midnight sun, occurs when there is no sunset from approximately 13 May to 29 July and the sun stays above the horizon for 24 hours.

The offshore branch of the Norwegian current in the North Sea embraces the coast of

Norway. It transports relatively warm, saline waters into the Arctic regions. It decreases the amount of ice in the western part of the Arctic Ocean and has a considerable warming influence on the climate of coastal Norway, making it warmer in winter and cooler in summer. All coastal areas of the Sørøya are ice-free during the winter.

*Photo Tor H. Bjørn*



***Plant names and vegetation types***

*Photo P. Nilsen*

# Plant names and vegetation types

Each nation has developed the common names for the plants growing around, but due to differences in languages and knowledge, the same plant species may bear many different common names, or the same name may be used for several different species. In order to precisely generalize knowledge of plants, a formal scientific procedure for naming and describing plant species has been developed over the long course of history.

Most Norwegian plants were described and named by famous Swedish botanist Carl Linnaeus, whose fundamental work laid the ground for the scientific nomenclature of plants. For accurate describing of plants and their parts there was used Latin language, as the common and international language of science. Latin names of plants have the advantage of being the same in all countries; they can be very descriptive and have their own little stories to tell. They are commonly binomial, constructed of two words – the name of genus and the name of species. Some names contain information

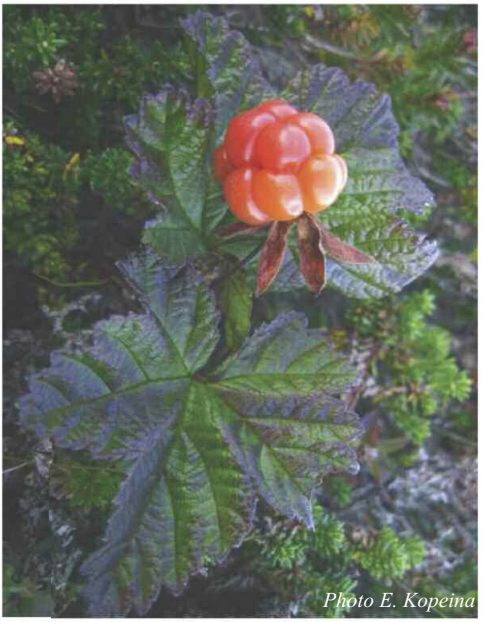


Photo E. Kopeina

*The Latin name of Cloudberry (Rubus chamaemorus) consists of its genus name "Rubus" (Latin word) and species name 'chamaemorus' constructed from two Greek words*

*Velvet Bells (Bartsia alpina) took her generic name in the memory of botanist J. Bartsch (1710-1938), friend of Carl Linnaeus. The species name 'alpina' is connected with its occurrence mainly in mountains alpine zone*

Photo E. Borovichev

Photo N. Koroleva

*Purple Saxifrage (Saxifraga oppositifolia). Name of the genus 'Saxifraga' means 'rock-breaker' and dates back to Dioscorides, the Greek physician and botanist (circa 40-90 AD). The species name 'oppositifolia' explains position of the leaves — two leaves opposite to each other; positioned along the stem in pairs*


*Sparse cover of Bog-bean (Menyanthes trifoliata) emerges on the shores of shallow lakes and starts formation of wetland vegetation, or 'hydrosere'*

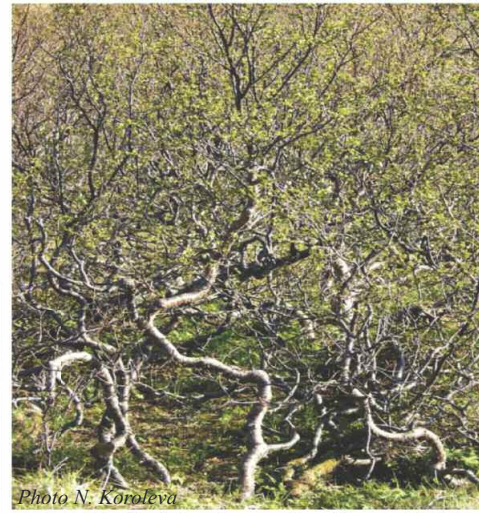

*Sea Lyme Grass (Leymus arenarius) is a pioneering species, one of the first plants appearing on sandy substrata on the Sørøya. It starts the succession called 'psammosere'*

about the plant (its appearance, characteristics, resemblance to other plants or even animals, etc.), others were given in the honor of some real or mythological (more often antique or pagan) personage. For example, the Latin name of Cloudberry, plant of county Finnmark (*Rubus chamaemorus*) consists of its genus name Rubus, which is derived from the Latin 'ruber' (red). The species name 'chamaemorus' is constructed by two Greek words – 'chamai' (on the earth) and 'moron' (Morus, Mulberry) and is descriptive of both the shape of leaves and the dwarf growth form.

Sometimes, scientific names of plants could be changed due to new taxonomical data. As a result, scientific names could vary in different publications. In this book we adopted scientific names used in Den nya nordiska floran (2003) by B. Moosberg and L. Steinberg for flowering plants, from Checklist of Norwegian Bryophytes by Frisvoll et al. (1995) for mosses, and from Lichen-forming and lichenicolous fungi of Fennoscandia by Santesson et al. (2013) for lichens.

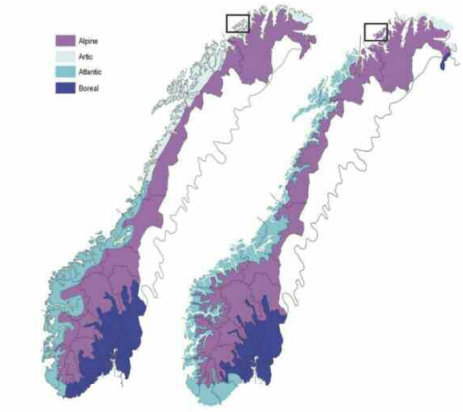
The vegetation is not a chaotic combination of plants and lichens. Starting with bare surface of land, plant associations succeeded one another until eventually a sort of equilibrium was reached and certain kinds of plant assemblages

*When plants start to occupy stony substrata, such succession of vegetation is called 'lithosere'*


*Mountain birch forests occur in valleys and in the lower parts of mountain slopes. Trees' trunks are twisted due to snow-pressure and snow-creep in winter and early spring*


*Major part of the Sørøya belongs to alpine (tundra) zone*




*Position of the Sørøya Island in the Biogeographical Division of Norway (Norwegian Mainland only). The map from the Pilot Project on Emerald Network is shown on the left and the adjustments of 2007 on the right. The Figure is from the report "Emerald Network in Norway - Final Report from the Pilot Project" / Directorate for Nature Management, 2007. The Sørøya Island (taken in the frame) is included now into the alpine zone*

take permanent hold in one or another habitat. Such a more or less stable composition of plants communities is a result of long-term vegetation development under regional macroclimate and local habitat conditions, which include properties of bedrocks and soils, altitude, water regime, sun and wind exposure, interactions with other plants, etc. Diverse plant communities mirror the habitat properties better than complicated laboratory equipment and in different habitats plants composition and cover differ substantially. The major groups of vegetation types of the Sørøya Island include subalpine mountain birch forests, alpine (tundra) communities, meadows and grasslands, wetlands, bare rock and scree and coastal communities.

On the map of Europe Biogeographic Regions the Sørøya Island belongs to the Alpine Region, which means that majority of plant communities here are mountainous. Sharp and rugged mountainous landscape significantly affects the diversity of vegetation, and everywhere in the mountains of the island there are vegetation belts or zones which can be

roughly compared with latitude zones in northern Europe. The main reason for vegetation change is the temperature drop with elevation increase; this micro-climate gradient is particularly evident on wind exposed mountain slopes. Furthermore, the rising and cooling of water-laden air-mass cause a higher level of precipitation on seaward and wind-exposed mountain slopes. Mountain summits have a harsh climate similar to the high Arctic, with strong wind, high precipitation, sharp temperature variations and snowfall even in summer.

Each zone carries its own type of plant life, though they merge into each other, and boundaries between belts aren't sharp and distinct. Two vegetation zones are represented on the Sørøya Island: subalpine (or orohemiarctic, or mountain birch zone) and alpine (or oroarctic, or tundra zone). Subalpine zone is fragmented and restricted to sheltered habitats on Sea terraces and in river valleys. This zone includes not only mountain birch forests, but also tall-grass meadows and mires, which are

Photo N. Koroleva

*Tufts of Racomitrium lanuginosum and prostrate dwarf shrubs dominate plant communities in the middle alpine subzone of the Sørøya*

Photo N. Koroleva

*A marked variation between plant communities in tundra zone is quite distinct due to microtopography and snow distribution: open vegetation is situated on the snow-free ridges, dwarf shrubs – on moderately protected slopes and Nardus stricta dominated grasslands – in depressions*

situated mainly near lakes and rivers.

Tundra zone is situated above the timberline, and its vegetation changes dramatically following a microclimatic gradient. It includes temperature drops 0.6° for every 100 m increase of elevation, severe winds, snow conditions and frost soils (due to sporadic permafrost). Tundra zone in mountains of the Sørøya is subdivided into three vertical subzones: a lower alpine, middle alpine and high alpine. Slope meadows, grasslands and mires, rock and scree vegetation are regular components of tundra zone on the Sørøya Island.

Lower alpine subzone lies on lower part of slopes, just above the tree line. There are prevailing dwarf birches and willows along with slope meadows and mires, bilberry and crowberry heath. The middle alpine subzone occupies flat stony summits and upper slopes of mountains. Alpine Azalea, Moss Campion, Mountain Avens, Woodrush, Three-leaved Rush and mosses (*Racomitrium lanuginosum*) and lichens (*Flavocetraria nivalis, Ochrolechia frigida*) are the most typical inhabitants on disconnected and prostrate fragments of heathlands. In the middle of July, a close examination of the high mountains rocky fields reveals a brilliantly colored painting formed by flowering cushion-like and prostrate plants. The high alpine subzone is situated on high summits and is characterized by patchy plant cover dominated mainly by lichens and mosses. Exposed rocks and boulders are covered by crustaceous and foliose lichens and some mosses. Melting snowfields are surrounded by special snow-bed vegetation composed mainly by grasses and mosses.

Coastal heaths and grasslands of the Sørøya Island are formed on the sea terraces, mainly in ancient glacier valley mouths or in shallow bays, on thin but fertile soils derived from marine pebble and alluvial sand. Some coastal grasslands are used as pastures and hay meadows.


*Damaged by larvae of moth Epirrita autumnata shrub-like mountain birch forest on the Gamvika Bay*


Mountain Birch forests
Photo N. Koroleva


*Wind-pollinated birch flowers are collected in drooping catkins. Birch pollen grains are produced in huge quantities and are resistant to decomposition processes, that's why they are fossilized, both in peat and lake sediments. Judging from these fossil records birch advanced to the north of Fennoscandia about 6-7 000 years ago, succeeding periglacial tundra after glacier retreat*

## Birch forests

Sørøya Island lies on the border of the polar tree-line. Birch forests of the island, like those forming the subalpine, subarctic and submaritime zones everywhere in Fennoscandia, are evidently characteristic for regions with oceanic cool climates. On the other side of the World, the Pacific coast of Sakhalin, the Kamchatka peninsula, and some Japanese islands have a corresponding ecological zone with another birch species, Betula ermanii.


*Mountain ash (Sorbus aucuparia subsp. glabrata) is a shrubby tree under these conditions. It has fragrant flowers and sour-bitter fruits, which are an important food resource for many birds*

On Sørøya the upper limit of birch is at a lower altitude than in more southern and more continental areas of Norway. They are often situated in sheltered river valleys and on terraces under steep mountain slopes. The dominant tree of this forest is Mountain Birch (*Betula pubescens* ssp. *czerepanovii*). Birch is highly adapted to this timber-line environment. It has very variable shape; polycormic trees (with several trunks starting from one point) are usually crooked, or twisted at the basal part owing to heavy snow-pressure and snow-creep and seldom higher than few meters. In sheltered

positions Mountain Birch often grows with a single straight trunk and may reach 10 m in height.

Many of the birches on Sørøya are sometimes heavily damaged by the Autumnal Moth (*Epirrita autumnata*), the larvae of which feeds on birch leaves and which periodically has severe outbreaks over large areas.

Birch has long been used as a major raw material, not only as firewood, but also for building: its bark was laid beneath the turf on turf roofs. In Sweden, the bark of birch trees is used to make a form of bread. Betulin from birch bark is reported to decrease cholesterol, obesity and improved insulin resistance. The buds and leaves of birch are used in both traditional and


*Arctic starflower (Trientalis europaeus) has nice solitary white flowers usually with six-seven petals. This type of flower is reflected in Russian ('Sedmitshnik') and German ('der Siebenstern') names*

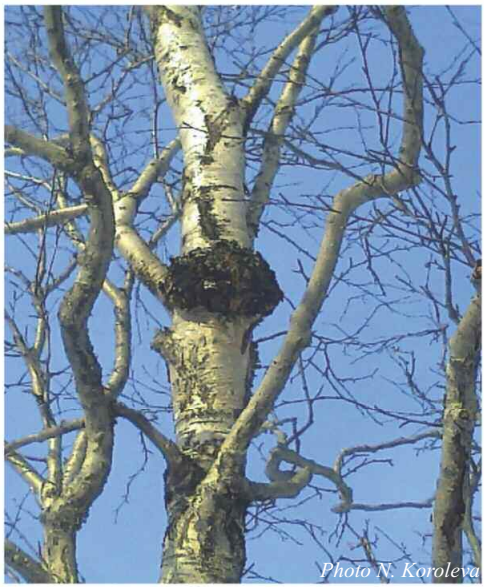

*Twinflower (Linnaea borealis) – a little trailing plant, with small evergreen leaves and upright flower stems, each bearing a pair of bell-shaped flowers. This lovely plant was Carl Linnaeus's favorite and was named in honor of this famous botanist*


*Cow-wheat (Melampyrum pratense) seeds have a fatty attachment on them called 'an elaiosome'. Wood ants take the seeds to their nests, and feed the elaiosome to their larvae, thus helping to disperse these plants*

official medicine as a diuretic, cholagogue, diaphoretic, bactericidal, anti-inflammatory and in wound-healing remedies. Birch is a host tree of parasitic fungus Inonotus obliquus (a birch fungus, chaga mushroom), which is widely used in Russian and Eastern European traditional and official medicine.

The subalpine forest also holds some other trees in addition to the dominant birch: Mountain Ash (*Sorbus aucuparia* ssp. *glabrata*), Goat Willow (*Salix caprea*) and Asp (*Populus tremula*) which occurs only as high bushes or stunted single trees. Species composition of birch forest is almost the same as in the lower part of alpine belt or in some meadows. Among species generally limited to the forest and adjacent lower alpine (tundra) belt are Swedish Cornel (*Cornus suecica*), Cow-wheat (*Melampyrum pratense, M. sylvaticum*), Arctic Starflower (*Trientalis europaea*). Very peculiar forest species are Wintergreens (*Pyrola minor, P. norvegica*) with small, white-pinkish, bell-shaped flowers in dense raceme.

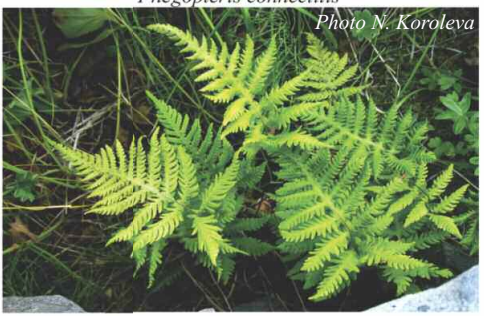
In the cold days of September an orange-



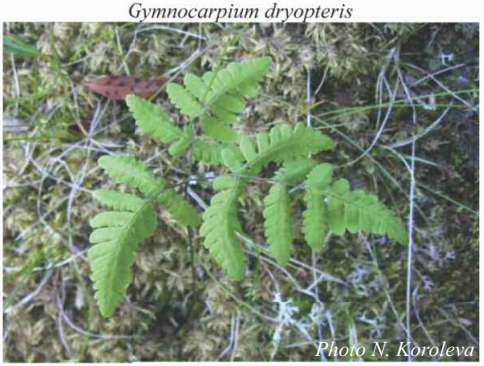

*The sterile conk of the parasitic fungus Inonotus obliquus (chaga mushroom) on a birch trunk. The Norwegian name ('kreftkjuke') means "cancer polypore" and is explained by the fungus' appearance or supposed healing properties*

*Ferns are widely distributed in mountain birch forest and in the lower alpine zone, usually in shady places, on wet and fertile substrata, sometimes in rock crevices*

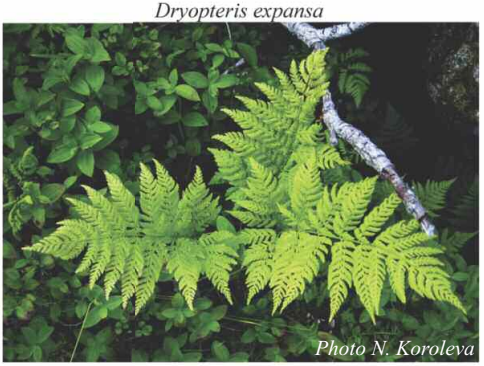
*Phegopteris connectilis*




*Gymnocarpium dryopteris*




*Dryopteris expansa*



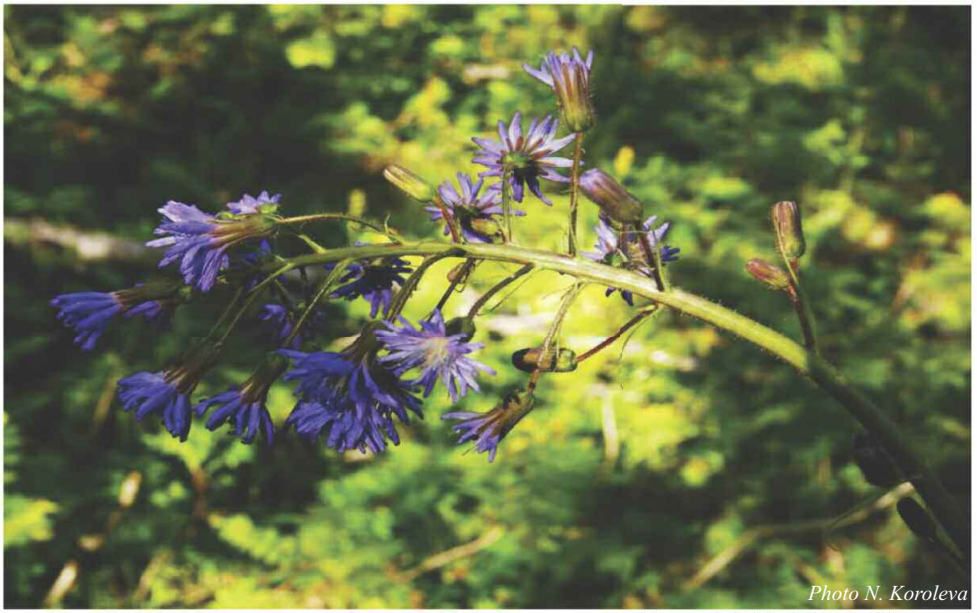
ochre luxuriant birch forest colorfully stands out against the mountain hills covered with snow. Eventually strong winds blow away the yellow leaves and snow slowly creeps downhill as winter approaches.


*European Goldenrod (Solidago virgaurea) is a common herbaceous perennial plant on stony ground in the birch forest of Sørøya. It is used in homeopathy, traditional and official medicine due to its astringent, anti-inflammatory, diuretic, antimicrobial properties*


*Norwegian Wintergreen (Pyrola norvegica) is an evergreen plant more typical in boreal forests. Its roots can reach the length of up to 6 m. As other Wintergreens, it has a mutualistic relationship with fungi forming a mycorrhiza (association of plant roots and fungal hyphae)*


*Stuff Clubmoss (Lycopodium annotinum spp. alpestre) is a flowerless vascular plant. Specialized leaves (sporophylls) contain spores in special spore-cases (sporangia) and are arranged in a cone-like strobilus at the end of stems. Clubmosses occur in both mountain birch and tundra zone*


*Swedish Cornel (Cornus suecica) has small, dark purple, almost black flowers collected in a tight umbel and surrounded by four conspicuous white petal-like bracts. The red berries are tasteless but non toxic*




*Alpine Blue-sow-thistle (Cicerbita alpina) is common species in herb-rich mountain birch forest of Sørøya*

***Alpine (tundra) zone***

*Photo N. Koroleva*

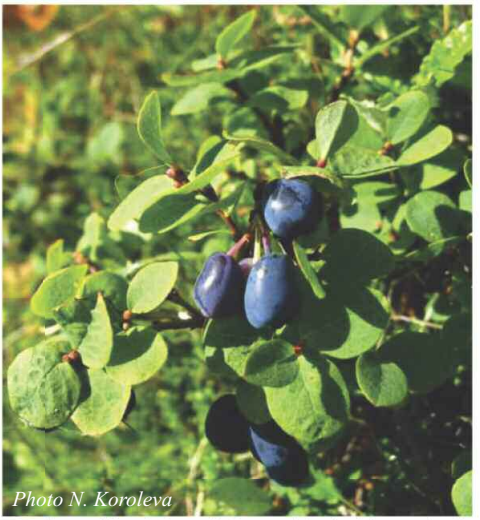
# Alpine (tundra) zone

Apart from lacking some of the trees, general plant cover of the lower alpine tundra on Sørøya also differs slightly from mountain birch forest. Biodiversity in the low-alpine tundra is usually richer than in neighboring subalpine forest. Swedish Cornell (*Cornus suecica*), Twinflower (*Linnaea borealis*), Arctic Starflower (*Trientalis europaea*) are common plants in both mountain birch forest and lower alpine belt.

But why do the forest species occur without


*Blue Mountain Heath (Phyllodoce caerulea) looks a little bit like Crowberry and has similar, but longer leaves and urn-shaped lilac flowers*


*Dwarf birch (Betula nana) is a shrub that ranges from prostrate to 1-1.2 m tall and has rounded leaves and erect fruiting catkins*




*Blueberry (Vaccinium uliginosum) is deciduous shrub with small, pink, bell-shaped flowers and dark blue, soft, oval to round, tasty, slightly tart berries, ripening from July to early September*


*Bilberry (Vaccinium myrtillus) is deciduous shrub with small, greenish-pink, bell-shaped flowers and black, soft, round, tasty berries. Leaves and berries are widely used in traditional and official medicine: leaves as anti-diabetic, berries as anti-inflammatory remedy and astringent in diarrhea*


*Heather (Calluna vulgaris) is the loveliest plant of the subalpine and lower alpine zone on Sørøya. It blooms plentifully in August with tiny lilac-violet flowers, densely covering every branch*


*In Russian cuisine berries of Stone Bramble (Rubus saxatilis) can be eaten with sugar or honey, and can be used in preparation of kissel, compote, jams and jellies*

their forest environment, in these low-alpine habitats? This is an interesting and unsolved ecological problem. Some scientists consider them to be relic from communities, which reached a higher and more northern position in the post-glacial warm period. In tundra some of them cannot reproduce by seeds and propagate only vegetatively. However, the low-alpine populations of species often differ in their ecology and even morphology: they look like 'miniature' versions of their counterparts below the timberline.

Without protection of trees, the strong winds leave their mark on vegetation. Due to the wind, snow cover above the timberline lies very unevenly: on exposed hillocks snow cover may be very thin while in sheltered habitats snow may exceed several meters. In exposed habitats forest shrubs take on a creeping appearance, and use every slanting depression, where they are snow-protected during the winter. The height of Dwarf Birch (*Betula nana*) shrubs is often a


*Grey Willow (Salix glauca) is a shrub up to 1 m tall, with narrow slightly haired leaves. It is an important food for reindeer, in winter it constitutes much of the diet for mountain hares (Lepus timidus)*


*Juniper (Juniperus communis spp. nana) is a shrub from prostrate up to 1.5 m tall. It is dioecious, with male and female cones on separate plants. The female seed cones are berry-like, from blue to purple-black are used to flavor meats, some beer and gin*


*Moss Campion (Silene acaulis) can form dense cushions up to a few decimeters in diameter, it usually has pink flowers and very rarely they are white. Some plants of Moss Campion were recorded to be 75-100 years old, the oldest known individual reached the age of 350 years being just 2 feet in diameter*

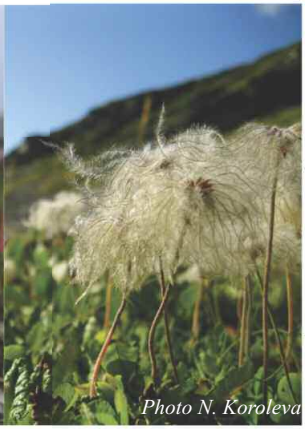

*Lapland Diapensia (Diapensia lapponica) forms with rosetes of tiny oval evergreen leaves small firm 'heap', covered by large solitary cup-shaped 5-petalled flowers*

good indicator of snow depth.

Some lower-alpine dwarf shrubs have delicious and vitamin-rich berries, which were of great importance for the daily life of native people. Blueberry (*Vaccinium uliginosum*), Bilberry (*V. myrtillus*), Crowberry (*Empetrum hermaphroditum*) and Lingonberry (*V. vitis-idaea*) were always among the most important traditionally used plants. Their berries also constitute a major part of the diet of birds and mammals on Sørøya.

Red-stemmed Feather-moss *(Pleurozium schreberi)* and Glittering Wood-moss *(Hylocomium splendens), Dicranum* and


*Curled or Rock Sedge (Carex rupestris) is low sedge with single erect spike and narrow rigid curly leaves. It grows on rocky calcareous soils*


*Mountain Avens (Dryas octopetala) has parabolic-shaped flowers, which turn face to the sun and concentrate sunrays at their focus. It increases activity of pollinating insects, which bask in Mountain Avens flowers. Its seeds with long hairs look like birds feather that is echoed in its name*


*The fruits of Mountain Crowberry (Empetrum hermaphroditum) are used to prepare juice and compote. It has high concentration of anthocyanin pigment and is believed to treat kidney diseases. Fermented crowberry juice is considered to be similar in taste and color to a red grape wine. Tiny flowers of Mountain Crowberry are both male and female (hermaphroditic), with three long stamens and short pistil. Mountain Crowberry flowers in early spring, and sometimes in late summer or in warm fall flowers again, so one can see both flowers and berries*

*Polytrichum* species are widely distributed among lower-alpine mosses. They sometimes form extensive thick mats along with liverworts such as *Barbilophozia lycopodioides*. Foliose lichens of the genus *Peltigera* and light-green colored *Nephroma arcticum* are very common in the ground-layer of the lower-alpine zone.

The mosaic of low-alpine tundra vegetation in autumn looks like a multi-colored carpet: scarlet, deep green, red ochre and silver-grey patches of shrub autumnal leaves among the moss cushions.

Transition from low-alpine to middle-alpine tundra on Sørøya lies at an elevation of 220-280 m. The change of community type is the result of temperature gradient and snow regime. In the low-alpine area snow forms a good protective blanket, exposed plains and ridges of the middle-alpine zone have rather thin snow cover or are almost snow-free. Plants here suffer from severe abrasion by wind-driven snow particles and desiccation. Most plants and lichens here form dense mats, tufts or cushions, which reduce wind movement. On a sunny day the air trapped within small gaps in the plant gets warmed up. The difference in the temperature between the inner part of the plant and surrounding air may reach 10-15°, especially when the plant has dark pigmentation.

Some alpine zone species of high ecological plasticity are common under a wide range of habitat conditions. Crowberry (*Empetrum hermaphroditum*) is well-adapted to the arctic and alpine environment, and inhabits heath, bogs, sandy beach ridges and rocky mountain slopes and plains. Alpine Bearberry

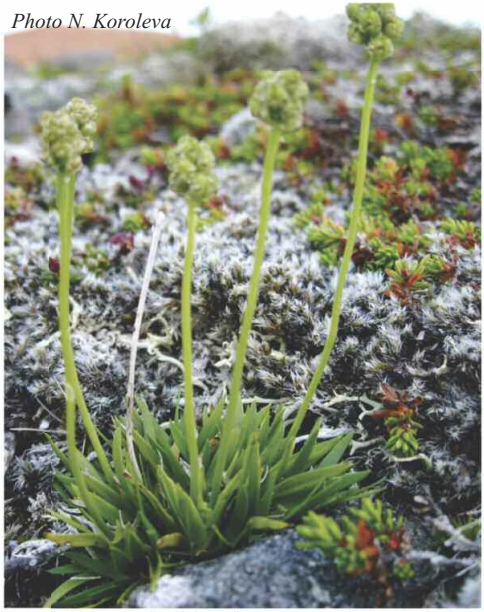

*Dark purple berries of Alpine Bearberry (Arctous alpina) are favorite food for Rock Ptarmigans (Lagopus mutus)*


*Leaves and berries of Lingonberry or Cowberry (Vaccinium vitis-idaea) are widely used in traditional and official medicine as diuretic, cholagogue, bactericidal and vitamin remedy*

(*Arctous alpina*), Lingonberry (*Vaccinium vitis-idaea*), Blueberry (*V. uliginosum*) and many other plants are common throughout all habitats of tundra (or alpine) zone.

Tundra vegetation of calcareous habitats differs from that in acidic environment. Mountain Avens (*Dryas octopetala*), Rock Sedge (*Carex rupestris*) and Moss Campion (*Silene acaulis*) are common on calcareous snow-free areas, while Crowberry (*Empetrum hermaphroditum*), Lapland Diapensia (*Diapensia lapponica*), and Alpine Azalea


*Alpine Azalea (Loiseleuria procumbens) is creeping alpine plant of stony habitats. It has waxy leathered evergreen leaves, which live for 2-3 years and have to withstand snow abrasion in winter*




*Scotch False Asphodel (Tofieldia pusilla) is small plant common in moist calcareous alpine habitats. Its densely tufted linear basal leaves are arrayed in the same plane, so the whole tuft looks flat*

(*Loiseleuria procumbens*) are more abundant on acidic substrata, where Heath Grey Moss (*Racomitrium lanuginosum*) forms an almost continuous carpet.

Troughs and valleys of the middle alpine tundra, where snow accumulates and melts late into summer are called snow beds. Plants here have to endure a delay in the start of the growing season and often grow on water-saturated soils that may also be subject to downhill soil creep. Extreme snow beds are dominated by the liverworts Juratzka's Anthelia (*Anthelia juratzkana*), *Gymnomitrion* species and mosses such as *Kiaeria starkei*. Snowbed Willow (*Salix herbacea*) and Moss Bell Heather (*Harrimanella hypnoides*) are characteristic species of snow beds. Mat-grass (*Nardus stricta*) forms dense mats in early snow beds and avoids calcareous soils.

Fragments of high alpine tundra can be seen on summits of northern Sørøya, above 400 m elevation, especially on stony fields and near permanent snow-patches, where Glacier Buttercup (*Ranunculus glacialis*) and Snowbed Willow (*Salix herbacea*) are characteristic plants. Lichens and mosses are important components of the high alpine tundra, where they cover large stones and bits of fine earth.


*Woodrush (Luzula multiflora ssp. frigida)*


*Bigelow's Sedge (Carex bigelowii)*


*Three-leaved Rush, Highland Rush (Juncus trifidus)*

*You have to use a hand lens to identify sedges, wood-rushes and rushes. They are monocotyledonous plants: sedges belong to Cyperaceae family, wood-rushes and rushes – to the Juncaceae family. Members of the sedge family have stems with triangular cross-sections, leaves of wood-rushes are flat and bear bunch of long white hairs, rushes have flat or cylindrical hairless leaves*



*Mat-forming Snowbed Willow catkins have transparent hairs, that provides their higher then surrounding air temperature owing to 'greenhouse effect'*


*Plant communities in habitats with considerable snow accumulation and where the snow lies far into summer are called snow bed communities. They display substantial variation in species number and composition mainly due to time of exposure and soil properties*


*Glacier Buttercup (Ranunculus glacialis) is reported as the worlds northernmost and the highest ascending flowering plant in European mountains. The species is included in Red Data Book of Russia, but is rather common on the damp rocks and in moist snow-bed habitats in high alpine zone of Fennoscandia*

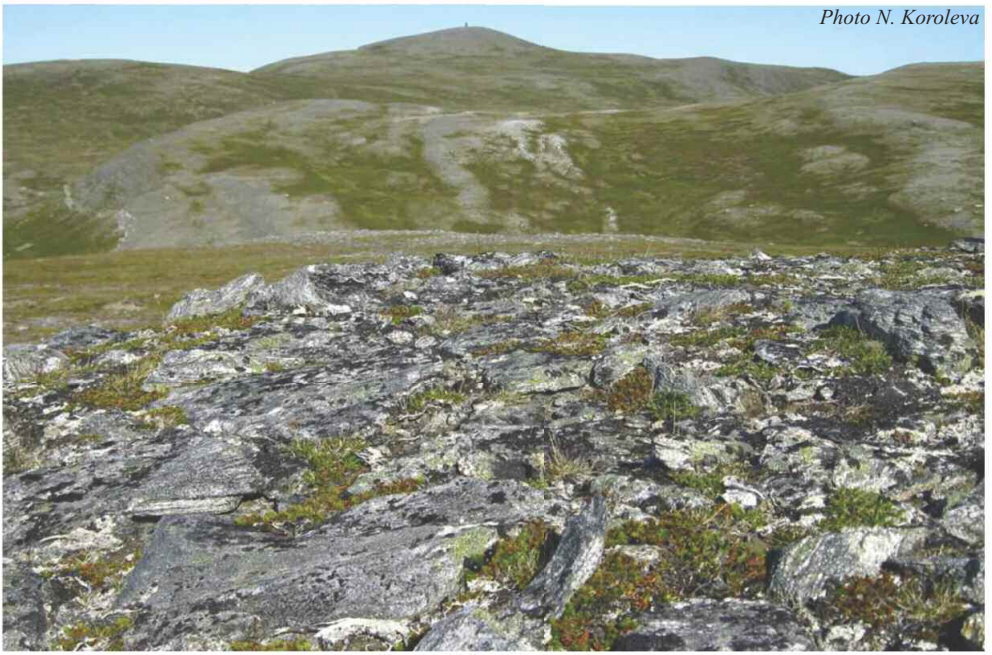

*Moss Bell Heather (Cassiope hypnoides, also known as Harrimanella hypnoides) is a creeping dwarf shrub with white or pale purplish bell-shaped flowers with pleasant aroma. It is common in snow beds, on stream banks and damp fine earth patches of the high alpine zone*


*Creeping Sibbaldia (Sibbaldia procumbens) is a species of the rose family (Rosaceae) characteristic of snow beds in the high alpine zone*



←*Alpine Bistort (Polygonum viviparum) produces bulbs rich of starch which are scattered like seeds and serve for vegetative distribution. These bulbs are preferred food for Rock Ptarmigan*

↑ *Cockscomb (Rhinanthus minor) is facultative parasitic annual plant*




*Open middle alpine tundra*

*Kingcup or Marsh Marigold (Caltha palustris) is common in running water, on damp marshy meadows, on moist banks of springs and rivers*

***Meadows and grasslands***

*Photo N. Koroleva*

# Meadows and grasslands

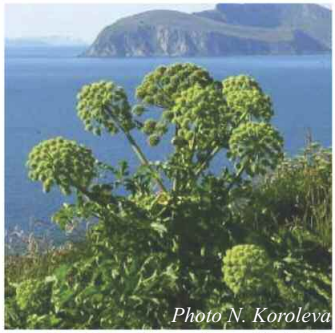
A large portion of the coastal zone and mountain slopes on Sørøya is covered by meadows. The proportion of meadows is rather high compared to continental regions of Norway. Most of the grasslands are restricted to wet, well-drained soils of coastal area and river valleys. Tall herb dominated meadows probably replace the declining mountain birch forests on the island. Herbs and dwarf shrubs share dominance on most of the meadows.


*Globe-flower (Trollius europaeus) is very decorative plant with a bright yellow, globe-shaped flower. It occurs in damp meadows and mountain birch forests along brooks and rivers and is reported as slightly poisonous*


*Wood Cranesbill (Geranium sylvaticum) is common and plentiful in tall herb and alpine meadows and as undergrowth of mountain birch forests*


*Melancholy Thistle (Cirsium heterophyllum) is a tall herb with leaves green and hairless above, thick white felted underneath. It also has a large purple inflorescence and a strong grooved woolly stem. The Melancholy Thistle is common and abundant on tall herb seashore meadows, in alpine meadows and in mountain birch forests*

Meadows and grasslands differ as to habitats and species composition. Mesic tall grasslands occupy river and rivulet valleys with fertile soils and plentiful moisture during summer season. They produce the most luxuriant vegetation and have characteristic flowering herbs. They are distributed from sea level to higher elevation in mountains. In the alpine zone fragments of this type of grasslands are found in the shelter of snow in rivulet valleys, ravines and shelves under steep cliffs. Common plants of this plant community include Melancholy Thistle (*Cirsium heterophyllum*), Geranium (*Geranium sylvaticum*), Alpine Sweet Vernal grass (*Anthoxanthum alpinum*) and Globeflower




*Angelica (Angelica archangelica) is a tall plant on alpine and subalpine meadows. Its tube-shaped young sprouts were traditionally used by Sami people as a salad*


*Alpine Lady's Mantle (Alchemilla alpina) has very decorative silvery hairy palmate leaves and used as a ground cover and in rock gardens*

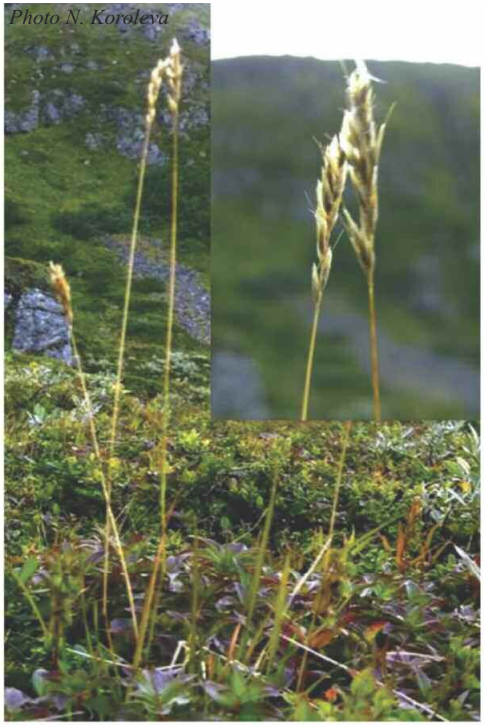
(*Trollius europaeus*).

When soil moisture increases, tall herbs and grasses like Meadowsweet (*Filipendula ulmaria*), Water Avens (*Geum rivale*) and Tufted Hair-grass (*Deschampsia cespitosa*) become dominant. Higher up the mountains, in the alpine zone, *Nardus stricta*-dominated small patches of grasslands indicate deep snow cover and impeded drainage in early summer in these habitats.

On damp well-drained, sea-exposed mountain slopes and sea terrains species-rich communities with a shared dominance of tundra dwarf shrubs and mesophilous herbs can be found. Mountain Avens (*Dryas octopetala*), Stone Bramble (*Rubus saxatilis*), Snow Gentian (*Gentiana nivalis*), *Gentianella aurea* and Cat's foot (*Antennaria dioica*) are most notable species. Grassland species include Alpine Saw-wort (*Saussurea alpina*), Melancholy Thistle,


*Bog star (Parnassia palustris) attracts pollinating insects by sterile stamens tipped with glistening drop-like false nectaries. One of five stamens becomes mature per day, so one can calculate how old the flower is. The carpel of gynoecia matures later on, to prevent self-pollination*


*Alpine Yellow-violet (Viola biflora) is a delicate plant with thin rounded leaves, fragile stem and yellow flowers. It grows in damp alpine and subalpine meadows, early snow beds and in mountain birch forests*





*True grasses (or Poaceae family) compose large part of grasslands and meadows. The strong scent of dried Alpine Sweet Vernal grass (Anthoxanthum alpinum) (on the left picture) is due to coumarin, a glycoside, and benzoic acid – it smells like fresh hay with a hint of vanilla. Alpine timothy (Phleum alpinum) (on the right picture) has short cylindrical to oval inflorescence*

Geranium and Alpine Sweet Vernal grass. Forest and low-alpine species, such as Swedish Cornel, Blueberry, Bilberry and Crowberry also occur on these meadows.


*Matgrass (Nardus stricta) is a densely tufted and wiry perennial grass avoiding calcareous soils and dominating in late snow patches on mountains*


*Spikes of Alpine Meadow-grass (Poa alpina) produce clones which germinate while still connected to the parent plant*


*Water Avens (Geum rivale) has nodding red flowers and burr-like seeds which are distributed by wind and by small mammals carrying seeds on their fur*

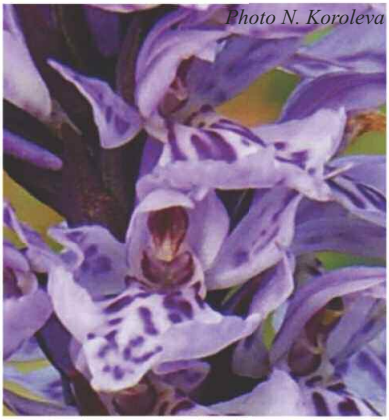

*Dried, naturally fragrant flowers of Meadowsweet (Filipendula ulmaria) are often used to give the air a pleasant smell and to flavor tea. Its leaves and flowers are a frequent addition as a spice to Scandinavian varieties of mead (honey beer)*


*Alpine Saw-wort (Saussurea alpina) has a dense head of blve and violet flowers with vanilla aroma. It occurs in alpine grasslands, on sandy sea terrains, on brooks banks*


*Frog Orchid (Dactylorhiza viride) has a dense spike-like inflorescence of small greenish flowers with the hint of purple or reddish color.*


*Dark Red Helleborine or Royal Helleborine (Epipactis atrorubens) is a strong tall plant with dark purple or reddish-brown flowers in loose inflorescences and strong vanilla aroma, especially in warm days. It occurs in warm and dry sandy soils, on seashore terrains and dunes. It is included in the Red Data Books of Murmansk Province and of Finland*


*Small-white Orchid (Pseudorchis albida) is reported as the northernmost and the highest ascending orchid species in Europe. Small-white Orchid is included in the Norwegian Red Data Book and in the Red Data Book of Murmansk Province*


*Heath Spotted Orchid (Dactylorhiza maculata) has 3-4 leaves spotted on the upper side and flowers varying from dark red to almost colorless, with pleasant strong aroma*

Orchid species are common in base-rich and calcareous mountain grasslands of Sørøya. Orchids have tiny seeds and require the presence of specific fungi in the soil for their germination. For the first few years juveniles can develop underground, being completely dependent on the fungal partner for their growth. It takes several years to develop from this stage into a fully grown flowering plant.

Species-rich meadows and grasslands make


*Harebell (Campanula rotundifolia ssp. groenlandica) is one of loveliest flowering plants of dry alpine, subalpine and seashore grasslands of Sørøya*

*Lesser Clubmoss (Selaginella selaginoides) is a non-flowering plant which resembles a moss. It has short slender perennial sterile stems and erect annual fertile shoots, which bear terminal cones of yellowish sporophylls with mega- and microsporangia. It inhabits peaty spring banks, damp alpine meadows, sandy seashore and dunes*

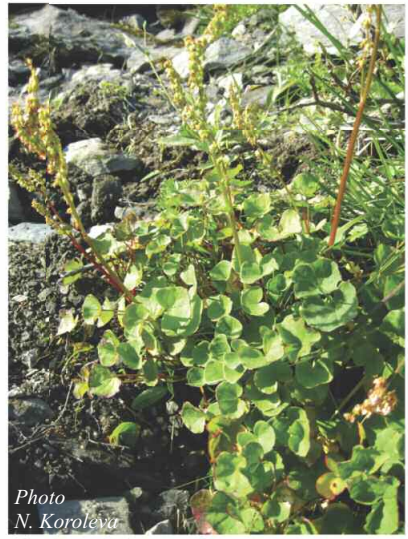
important input to island biodiversity, some of the insects and vascular plants are strictly limited to these communities. Moreover, grasslands are essential element in the life cycle of numerous birds and mammals. People of Sørøya use meadows for sheep grazing and hay.


*Netleaf Willow (Salix reticulata) is a prostrate deciduous shrub, leaves with impressed veins are glossy green above and felted beneath. It grows on wet, often slightly calcareous alpine meadows, rock river banks and sandy shores*


*Chives (Allium schoenoprasum) are a bulb-forming herbaceous perennial plant. Its hollow and tubular stem and young leaves are rich in vitamin A and C and traditionally used in cooking*


*Yellow Mountain Saxifrage (Saxifraga aizoides) has flowers polymorphic in their color: the petals vary between bright yellow, reddish yellow with red dots, and purple. It forms patchy mats on brooks banks, in damp meadows along streams, and even on peaty fens*


*Valerian (Valeriana sambucifolia) occurs on sea-shore meadows, in rock outcrops and in mountain birch forests. Valerian is a well-known and well-efficient medicinal herb especially as a tranquillizer and sedative and has been shown to improve sleep quality and reduce blood pressure*

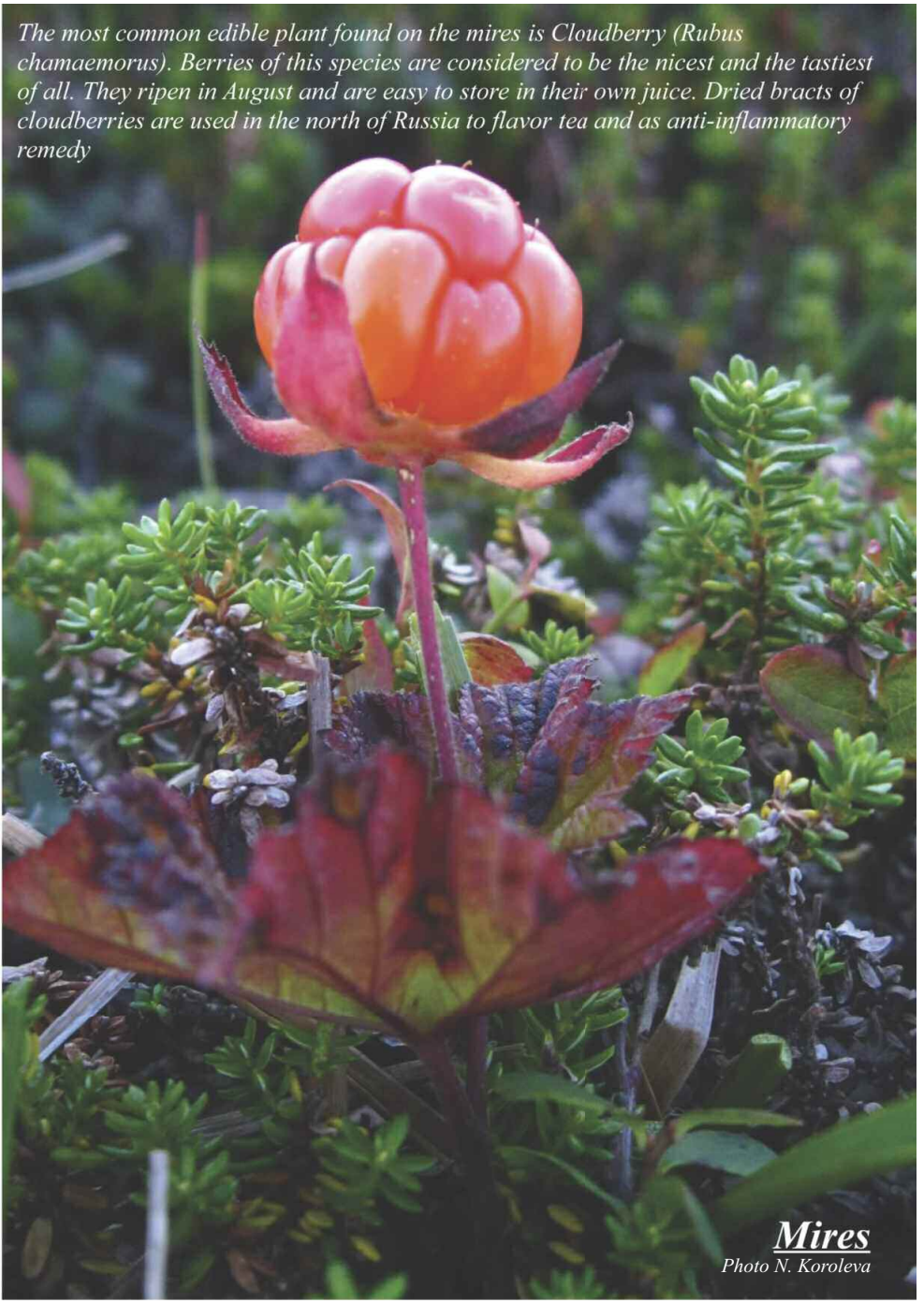



*Fresh green fleshy leaves of Mountain Sorrel (Oxyria digyna) have strong acidic taste and are rich in vitamin C*


*Common moonwort (Botrychium lunaria) is a small fern with dark green fleshy leaves divided into a sterile and a fertile part. The fertile part bears rounded, grape-like clusters of sporangia with spores by which the fern reproduces. Common moonwort occurs on alpine dry grasslands, on warm and dry banks and roadsides*


*Snow Gentian (Gentiana nivalis) is one of loveliest plants of alpine meadows. Plants of genus Gentiana are common in mountainous areas, where there are centers of Gentiana species diversity*

*Hay meadows in the Gamvik bay*



*The most common edible plant found on the mires is Cloudberry (Rubus chamaemorus). Berries of this species are considered to be the nicest and the tastiest of all. They ripen in August and are easy to store in their own juice. Dried bracts of cloudberries are used in the north of Russia to flavor tea and as anti-inflammatory remedy*

***Mires***
*Photo N. Koroleva*

# Mires

Mires – are areas with high water table, often with peat formation. Water-loving plants dominate here. High humidity and reduced evaporation are responsible for mires of various types to be widespread all over Fennoscandia. Slow decomposition of plant remnants under saturated condition and low temperature results in the accumulation of partly decomposed material named peat. The formation of peat on Fennoscandian mires started in postglacial times. Peat conserves plant and animal remains (named macrofossils) and has registered many significant events which have taken place in the area during this period. For example, evidence of succession in plant cover after glacier retreat can be seen by looking at different layers in the peat going back over time.


*Deergrass (Trichophorum cespitosum) forms dense tufts on acidic bogs and wet heaths*

The thicker peat is, the less plants are influenced by mineral nutrient in ground water. Eutrophic and intermediately nutrient-rich (mesotrophic) mires are named *fens*, and


*Horsetail- and sedge-dominated mires and wetlands on the shoreline of numerous shallow small lakes*

oligotrophic nutrient poor mires are termed *bogs*.

Mountain ranges of the Sørøya Island are interspersed by river valleys, lakes and springs, whereas on poorly drained shores lawn-like sedge- and Bog-cotton-dominated fens prevail. Besides these valley fens there are a lot of sloping mires, particularly in shallow depressions on gentle slopes. Near springs and lakes on flat terraces and low summits there are flat hummocky bogs, combined with strings of fens. High hummocks combined with wetter sites are conspicuous and attract much attention. They were formed due to local temporary permafrost, and in early summer one can find a lens of frost turf inside hummocks. They have been given Finnish name "pounikkos" and


*Bog rosemary (Andromeda polifolia) is a low evergreen shrub with narrow leathery leaves, occurring on acidic peaty bogs*


*Valley mires are formed in shallow depressions and on lake and river banks*

have been observed all over northern Lapland.

Microclimate of mires (especially of bogs) is severe for plants because of contrasting substrate water and temperature regime, low nutritional supply and high acidity of the substrata. Among "specialists" growing on mires there are Cottongrass (*Eriophorum angustifolium*), Bog Rosemary (*Andromeda polifolia*) and sedges (*Carex rostrata, C. aquatilis, C. rotundata*), as well as Deer Grass (*Trichophorum cespitosum*) and Horsetails (*Equisetum fluviatile* and *Equisetum palustre*). Sphagnum mosses are the commonest components of mires: there are a number of different Sphagnum species on dry hummocks as well as in soggy hollows.

Mires of the Sørøya Island are habitats for birds which forage and breed on small lakes and surrounding bogs and fens.

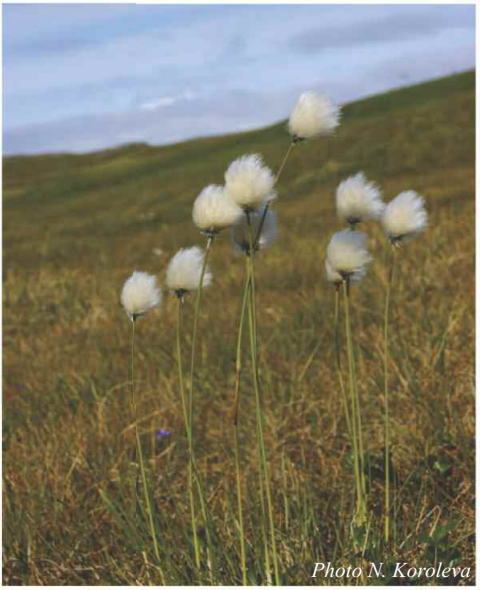

*Round Sedge (Carex rotundata) has separated pistillate (lower spikes) and staminate (higher spikes) inflorescences*

*Photo N. Koroleva*

*On gentle slopes and flat hilltops in the alpine zone there are mires with distinct hummocky microrelief. Hummocks are obviously relic from so-called Little Ice Age, which occurred in Scandinavia between the 16th and 18th centuries. These hummocks (named in Finland 'pounikkos') were formed due to a frozen ice core in the peat surrounded by mineral soil*


*Common Cottongrass (Eriophorum angustifolium) has several flowerheads with long white bristles, which increase the temperature of the reproductive organs during the cold summer and help seed dispersal. The heads fiber has been used as an addition to sheep wool in woolen textile manufacture*


*Marsh Cinquefoil (Comarum palustre) inhabits fens, lake shores and peaty meadows. It is used in traditional medicine as anti-inflammatory and analgesic remedy and to stimulate the cardiovascular, respiratory and digestive systems*




*Arctic Cottongrass (Eriophorum scheuchzeri) is tussock-formirg plant with solitary white flowerhead*


*Round-leaved Sundew (Drosera rotundifolia) is an insectivorous plant (consuming insects is an adaptation to supply itself with nitrogen). Its leaves are covered with dense tentacles with glistening drops which attract flies and mosquitoes. They get glued to the sticky leaves, whereupon the tentacles bend over, holding the insects inside until they are digested*


*Hooked Scorpion-moss (Scorpidium scorpioides) grows in wet hollows and indicates thin turf layer and minerotrophic conditions*

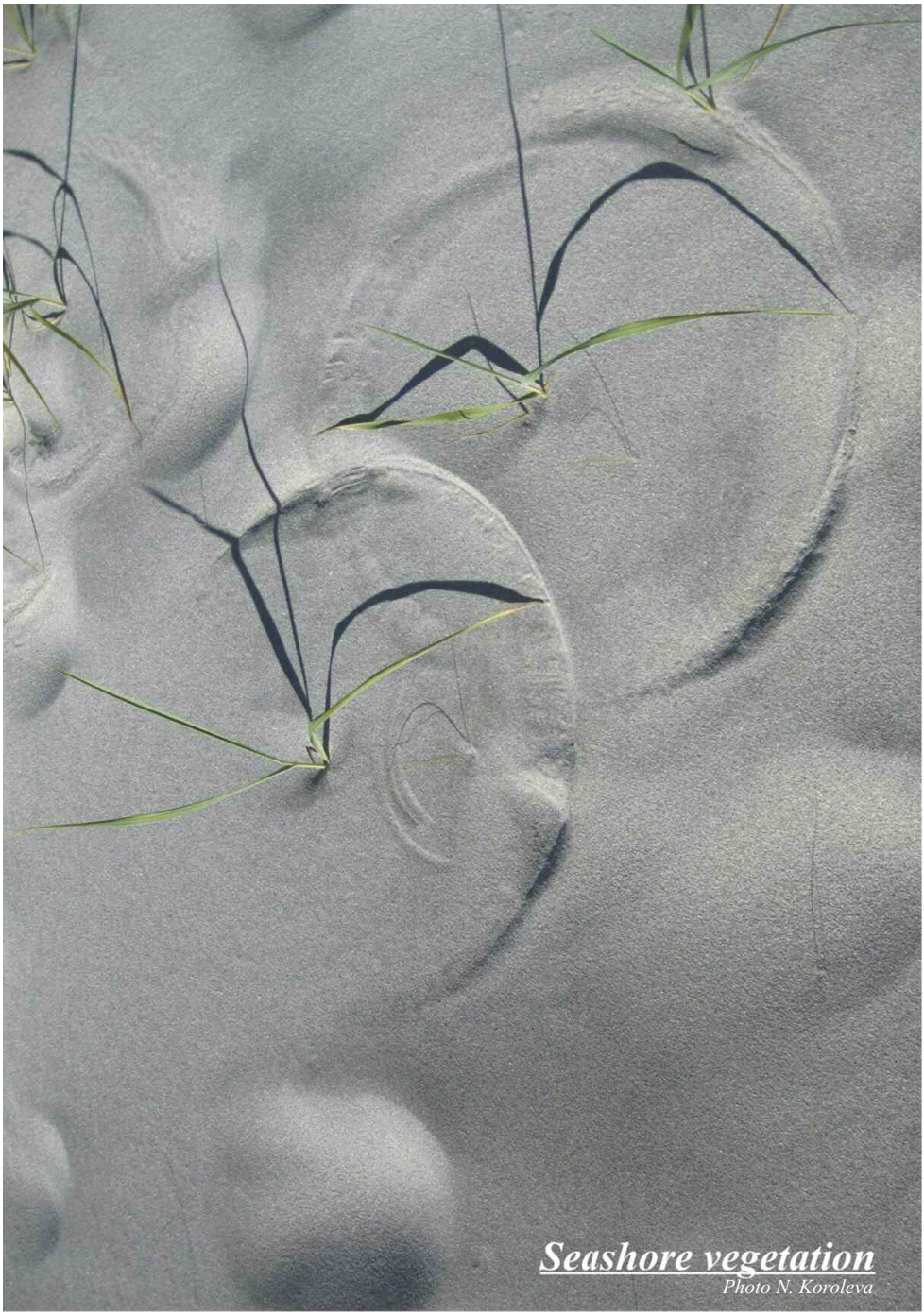

*Sphagnum species are famous of their ability to store water; some species can hold up to 20 times their dry weight in water. Dried Sphagnum moss was used as an insulating and water-absorbing material. Since it inhibits growth of bacteria and fungi, it has been used for centuries as wounds dressing, for storing vegetables and food preservation*


*Marsh Horsetail (Equisetum palustre) often forms extensive communities on peaty stream and lake shores. In traditional and official medicine it is used as diuretic and improving salt-water metabolism remedy*


*Large Yellow-sedge (Carex flava) grows on peaty soil with water flow from calcium-containing bedrocks*


*Whortle-leaved Willow (Salix myrsinites) has green shiny leathery leaves and short hairy catkins, old withered overwintered leaves stay at the base of young twigs. It grows on eutrophic fens, along seepage water course, often on calcareous soils*


*Some liverworts of Scapania genus are common in flarks of sloping fen*



***Seashore vegetation***
*Photo N. Koroleva*

## Seashore vegetation

Sea coasts are one of the most colourful and attractive Norwegian landscapes. There are rocky shores and cliffs facing the vast ocean and beautiful beaches with shiny white sand or darkly glistening round pebbles.

The prevailing coastal forms on Sørøya are fjords and true cliffs with narrow stony surf terraces. Broad pebbly and sand coastal terraces and sandy coastal dunes developed in wide shallow bays as a result of marine abrasion and land elevation during the past Holocene epoch. Their present appearance results from the downward movement of the coastline after glacier retreat and isostatic uplift of the land. Wind and wave action have shaped accumulations of sand and other sediments. Steep cliffs usually have limited amount of vegetation, but flat sheltered areas in fjord bottoms and calm bays, often associated with glacial valleys and stream outlets, are important sites for plants.

As a rule, sandy beaches are continually changing. This is due to storms, permanent winds and organic material (seaweed, animal remnants) deposition along the edge of the extreme storm tideline. The coastal landscape supports specific flora and vegetation. The plants are affected by specific marine ecological factors as seasonal and diurnal temperature equalizing, unhindered effect of the wind, stronger irradiation and haline effect of the sea water. Intensive sheep grazing and trampling also affect the presence and abundance of some coastal vascular plants. Coastal landscape is characterized by obvious zonation of the vegetation: the further away from the shore, the clearer this transition from marine to inland conditions is. Physical conditions associated with the transition include decreased flooding, salt leaching and cover by drifting sand, increasing humification of soil, etc.

The vegetation-free part of a sandy beach washed by waves is called 'the foreshore'. 'The backshore' extends from the line of extreme high


*Sandy beaches in the bays of the Norwegian Sea present the most scenic landscapes of the island*


*Sea Plantain (Plantago maritima) has linear thick fleshy leaves which can be used in salads. It has a very strong taproot which anchors the plant in moving sand*

water during storm floods, back into the dunes or other areas of established closed plant cover.

Most coastal plants of Soroya are also common on the arctic and cool temperature coasts in various different parts around of Northern Hemisphere.

Vegetation on dry sandy, stony and pebbly beaches of Sørøya is rather species poor and to some extent similar in composition. It can look like a desert with scattered patches of grasses. On shingle and gravel beach one can encounter solitary specimens of unusual water-storing Oyster-leaf (*Mertensia maritima*). Patches of


*Sea Lyme Grass (Leymus arenarius) forms large and tough gray-green to blue-gray colored patches with long underground runners. It is widely distributed at the base of coastal cliffs, on beaches and dunes, and together with some other grasses is used in stabilizing sandy substrata on northern coastal beaches*

Sea Sandwort (*Honckenya peploides*) occur on sand and gravel beaches that may be exposed to occasional storm water inundation.

Tall, blue-green Sea Lyme grass (*Leymus arenarius*) inhabits even scanty sand patches of shingle beaches and forms extensive communities above the tide line on sandy beaches. This is one of the most competitive and fast growing grasses, and can build up dunes to a height of several meters. Owing to its rapid vegetative increase it can 'follow' the moving dune substrata. This is why mono-dominant Sea Lyme grass communities don't resist to the sand shifting and wind erosion of dunes.

Arctic Sea Rocket (*Cakile arctica*) forms a narrow fringe on the seaweed residues, partially or entirely covered by sand. The communities


*Oyster-leaf (Mertensia maritima) has fleshy water-storing leaves and bell-shaped shiny blue flowers. Its inflated fruits are adapted to marine dispersal*

are obviously ephemeral phenomena – they easiily get destroyed by storm floods, sand accumulation, sheep and reindeer grazing, and disappear during the winter as some community of annual plants, overwinter as seeds and thrive again in a spring. Common Silverweed (*Argentina anserina* spp. *anserina*), Eged's Silverweed (*Argentina anserina* spp. *egedii*) and nitrophytic and moderately salt-tolerant Spear-leaved Orache (*Atriplex prostrata*) occur on shingle coast, in areas that become enriched by littoral-fringe deposits of high storm floods.

Further inland ericaceous shrubs, grasses, forbs and sedges gradually replace the Sea Lyme


*Sea Sandwort (Honckenya peploides) easily forms vast loosely or dense clumps on gravely, stony or sandy substrata just beyond the normal tide line*

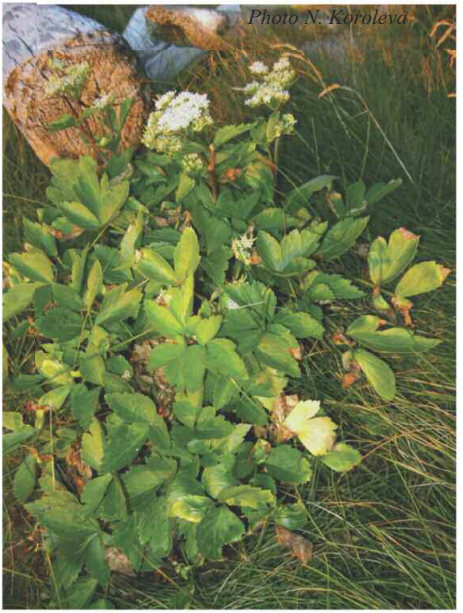
grass as the beach gets uplifted and the substrate gets more stabilized. The species composition depends on the soil and hydrological characteristics. Seashore succession proceeds to coastal crowberry heathlands, Mountain Avens and herbs-dominated low dry grasslands and tall


*Populations of Curved Sedge (Carex maritima) easily colonize sandy beaches and dunes*


*Arctic Sea Rocket (Cakile arctica) has shiny, fleshy leaves, white to light purple flowers and segmented fruits. Leaves, stems and flower buds are mainly used as a spice, as they have a bitter taste and are rich in vitamin C*

herbs-dominated mesophytic meadows.

There are fragments of salt marshes on clay soil in sheltered positions below the high tide mark – but on Sørøya this habitat is quite rare.




*Sea Parsley, or Scotch Lovage (Ligusticum scothicum) grows in stony and gravely coasts. All parts of the plant have strong parsley smell and taste and can be used to flavor a traveler's breakfast*

*Spear-leaved Orache (Atriplex prostrata) is annual herb with fleshy leaves and male and female flower buds sticking together in balls on the same plant. It inhabits seashore fringe of seaweed*

*Photo N. Koroleva*

*Photo N. Koroleva*

*Sea Pea (Lathyrus japonicus) grows on sandy or gravelly sea shores, and sandy terrains and dry seashore meadows*

*Common Silverweed (Argentina anserina spp. anserina) and Eged's Silverweed (Argentina anserina spp. egedii) are perennial herbs from the rose family Rosaceae. They are widespread in coastal areas*

*Photo N. Koroleva*

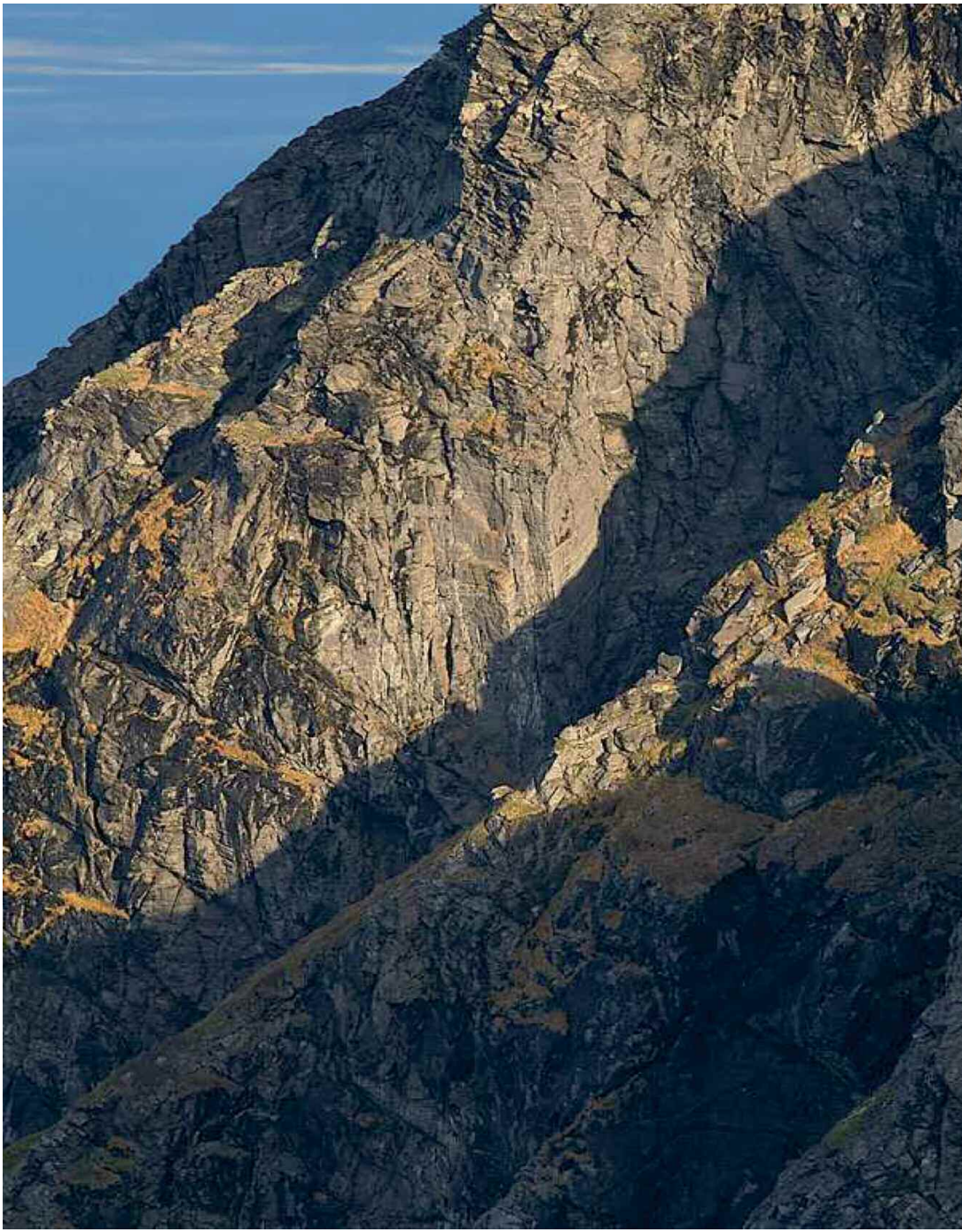

*Common Scurvy Grass (Cochlearia officinalis) is abundant on sea exposed cliffs and rocks on marshes, and in bird colonies. As the plant is rich in vitamin C, sailors used it to prevent and to combat scurvy. Young leaves have slightly peppery taste and can be used in cooking*

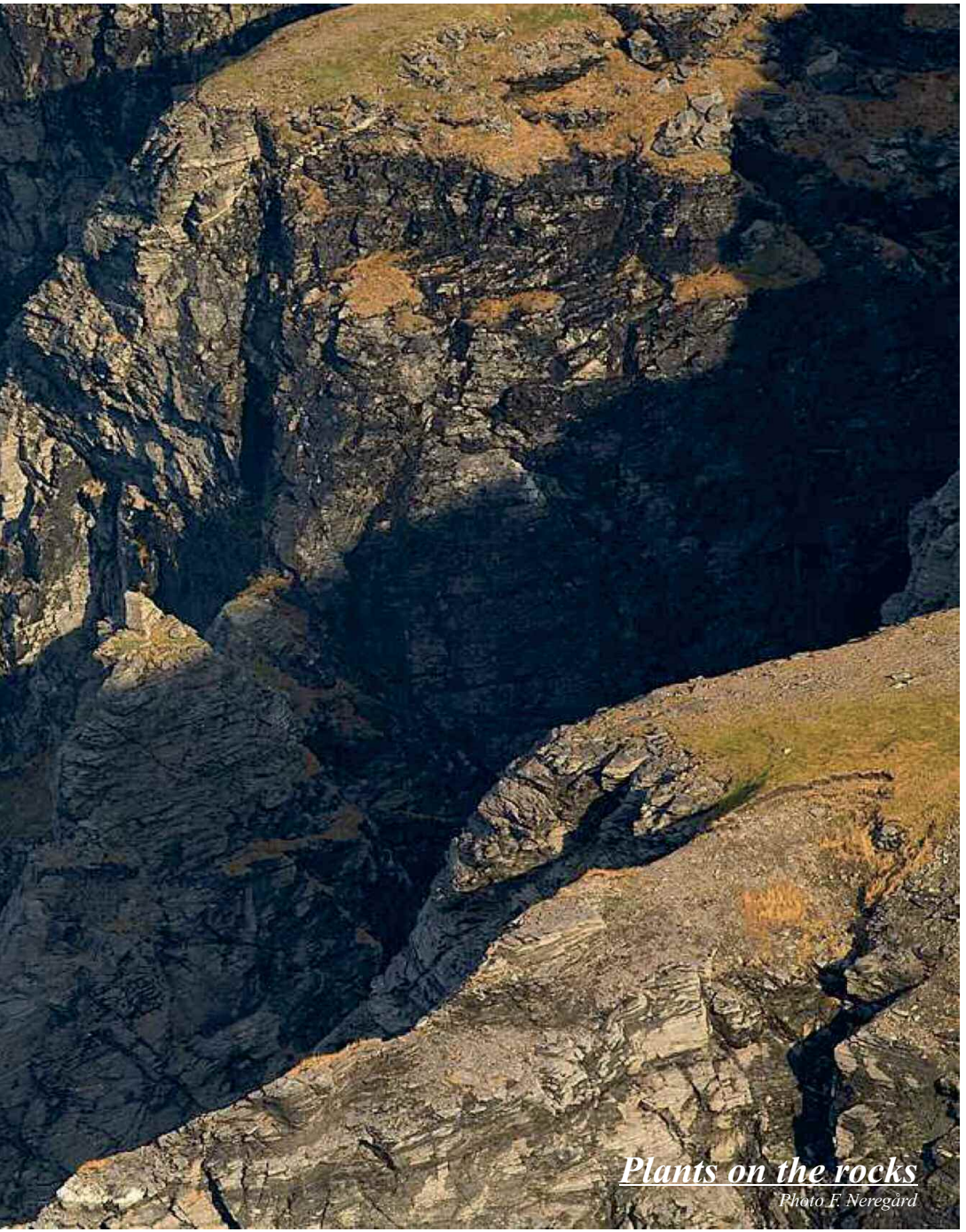

*Sea Mayweed (Tripleurospermum maritimum) occurs on sandy and shingle beaches, in bird colonies, seashore pastures and wastelands*


*Common Saltmarsh Grass (Puccinellia maritima) grows on moist saline soil, on rock shelves and on seashore grasslands*


*Sea Campion (Silene uniflora) is coastal plant with numerous solitary flowers and pointed waxy leaves*


*Rush-leaved Fescue (Festuca rubra ssp. arenaria) forms loose tufts on sandy seashore*





***Plants on the rocks***

*Photo F. Neregård*

## Plants on the rocks

Bare rocks appear frequently everywhere in Fennoscandia, especially in coastal areas. Vegetation on rock is primarily determined by the chemical composition of the rock, state of weathering, exposure, moisture and micro-structure of the surface. The competition in these habitats is slight or nonexistent at all, and bare rocks are inhabited by some species, which are rare in surrounding plant communities.

Bedrocks on Sørøya are represented by steep rugged sun and sea exposed or shady cliffs, screes, horizontal bedrocks, rock fissures and shelves, and large or small


*Common Stonecrop, or Biting Stonecrop (Sedum acre) has succulent water-stored leaves. It grows on dry sea-exposed rocks, shingle beaches and in sandy meadows*


*Goldenroot, or Roseroot (Rhodiola rosea) grows on sea exposed cliffs, on banks of springs and lakes. It has been used traditionally in Norway, Sweden and Russia as a tonic herb, as the remedy to enhance mental function, fight a fatigue and depression. In spring farmers used sprouts of Goldenroot to give energy to domestic animals after hard winter. It explains local traditional name of this plant – 'calvedance'. Collection of Roseroot from the wild can destroy the populations, but luckily it can be successfully cultivated*

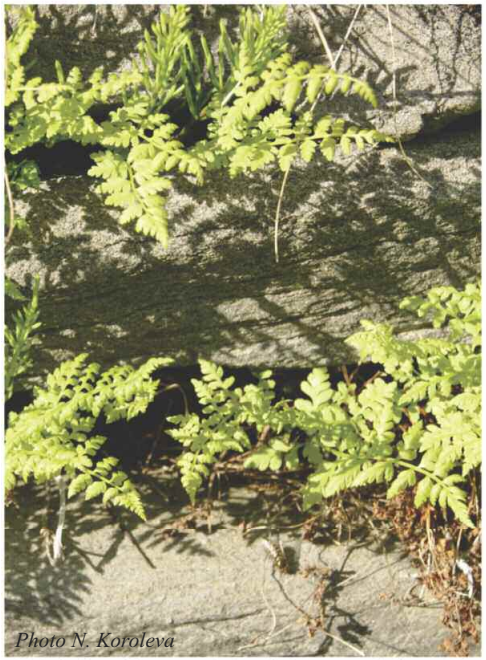
boulders. Rocky banks of springs and waterfalls, cracked stones and cliffs provide a variety of habitats accommodating a lot of different plants on a small area. Climbing around the cliff which looked at the distance like a bare surface you discover a lot of diverting plants and lichens.

Primary colonization of rock is started by specialists, mosses and lichens. Crustaceous (their thallome looks like a crust on the rock) and umbilicarious (their thallome looks like a small and sometimes dissected umbrella) lichens are the earliest pioneers, often spreading over all surfaces of the rock. On later stages of succession humus and mineral particles are collected in rock crevices or between boulders, where herbs, dwarf shrubs and even seedlings of trees begin to grow. This vegetation succession goes fast on wet and water-sprayed rocks along streams and waterfalls. In this habitats algae (more abundant are colonies of blue-green *Nostoc*), liverworts and mosses are pioneers, followed by grasses and sedges, next by some willows and mountain birch. Succession on the rock progresses to interspersed fragments of closed grasslands, alpine tundra and even mountain birch forest, if succession course is not interrupted by plant tuft moving down with snow or by sloping processes.

Bird cliffs and rocks represent specific habitats, which are constantly and strongly influenced by birds (manured, covered by debris, etc.). Colonies of birds nesting on cliffs and feeding in the sea transport nitrogen from the sea to land during spring and summer. Bird cliffs and fragments of bird meadows form complex habitats on rock ledges and under the bird colony, which receive flushes of nutrient especially during snowmelt and runoff. Common Scurvy Grass (*Cochlearia officinalis*), Cow Parsley (*Anthriscus sylvestris*), Sea Mayweed (*Tripleurospermum maritimum*) and Rush-leaved Fescue (*Festuca rubra*) form here luxuriant cover.

Some plants growing on rocks readily inhabit roadsides, ditch banks and edges and settlements clearings. Some of them (i.e. Saxifrages, Butterwort, Moss Campion, Mouse-ear) are very suitable to cultivate in alpine gardens.


*The colony of the Great Black Cormorant (Phalacrocorax carbo) on seashore rocks*




*Brittle fern (Cystopteris fragilis) is a small fern with very fragile fronds, as its Latin name means. It is very common and widely distributed in alpine and subalpine zone, on banks and cliffs, under shelves and in rock crevices*


*Northern Holly Fern (Polystichum lonchitis) is an evergreen fern with erect linear fronds. The sori on the lower side of the fronds are covered by grayish white indusium. Northern Holly Fern grows in rock crevices or at the base of boulders*


*Parsley Fern (Cryptogramma crispa) has separate sterile and fertile fronds. It grows amidst rocks and boulders in alpine zone*


*Common Polypody (Polypodium vulgare) is a small fern with leathery fronds ('leaves'). On the lower side of the fronds there are found the sori with yellow to orange spores. Common Polypody inhabits shady rock cracks and ledges in alpine and subalpine zone*


*Ophioparma ventoza*


*Umbilicaria cylindrica*


*Group of epilythic pioneer lichens, Rhizocarpon sp. (green-yellow) in center*


*Parmelia saxatilis*

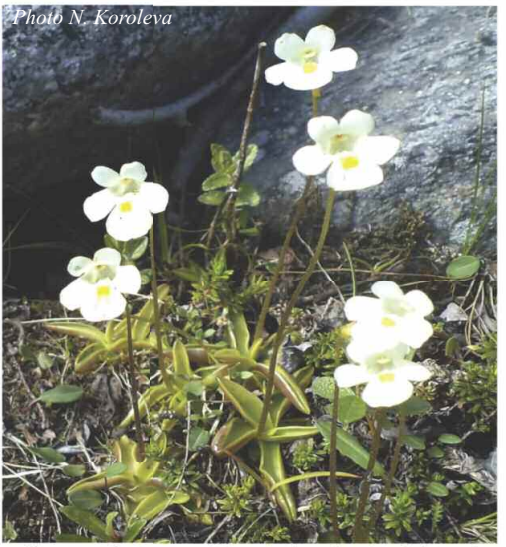

*Heath Grey Moss (Racomitrium lanuginosum)*


*Mountain Pincushion (Hymenoloma crispulum)*

*Pioneer lichens and mosses on rocks are called 'epilithous'*


*Preissia quadrata – thallose liverwort preferring moist base-rich rocks*


*Thallose liverwort Sauteria alpina occurs on Ca-rich rock covered by fine earth*

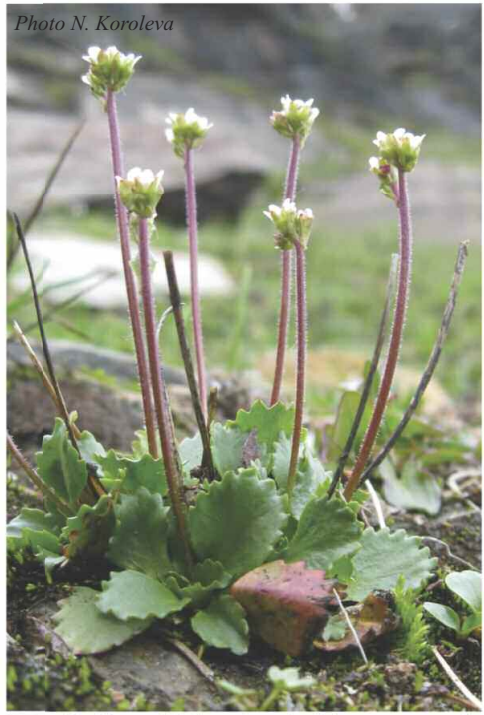




*Common Butterwort (Pinguicula vulgaris) (left) and Alpine Butterwort (Pinguicula alpina) (right) are insectivorous plant with glandular hairs on the upper surface of fleshy leaves in basal rosette. These hairs excrete mucilaginous sticky droplets, which trap the insects, and enzymes, which digest them. In the end of growing season Butterworts forms overwintering bulbil under weathered leaves and litter and overwinters with its help*

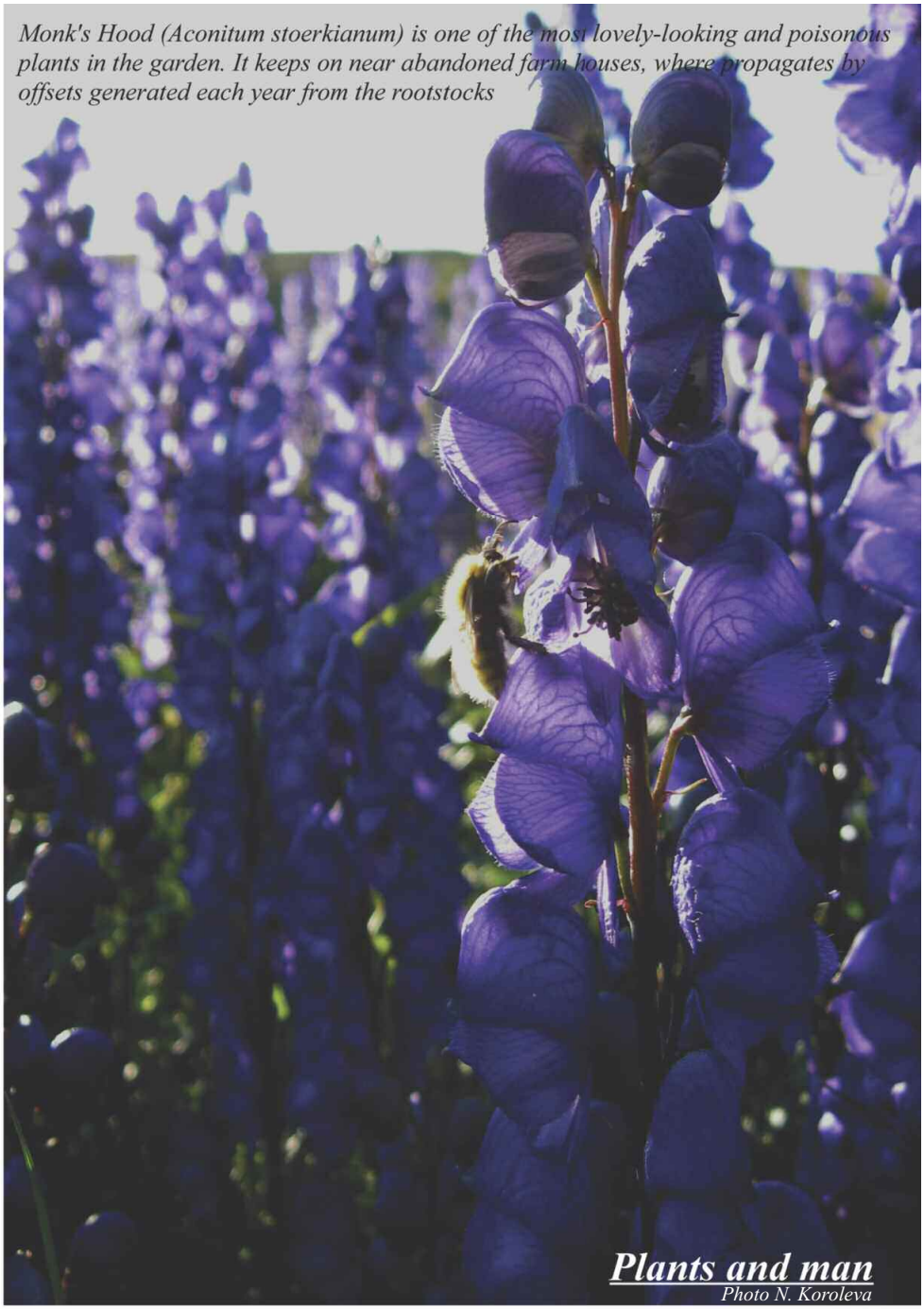

*Tufted Alpine Saxifrage (Saxifraga caespitosa) forms dense tufts on rock ledges and gravelly habitats in alpine zone*


*Alpine Mouse-ear (Cerastium alpinum) grows on rocky ledges, in dry tundra, in various disturbed habitats*


*Starry Saxifrage (Saxifraga stellaris) has white flowers with regularly spreading petals, which look like small stars. It grows in damp precipices and rocks, on stream and spring banks and seepage stony surfaces*




*Snow Saxifrage (Michranthes nivalis) occurs on rock walls and ledges, rocky outcrops, and alpine edges. The photosynthesis in green overwintered leaves of Snow Saxifrage starts as soon as they are exposed to the light, and these leaves function at least in early spring, withering to the middle of summer*



*Monk's Hood (Aconitum stoerkianum) is one of the most lovely-looking and poisonous plants in the garden. It keeps on near abandoned farm houses, where propagates by offsets generated each year from the rootstocks*

***Plants and man***

*Photo N. Koroleva*

## Plants and man

All plant species now present on the Sørøya island are considered to arrive after the ice sheet uncovered the land approximately 10,000 years ago, it is sometimes difficult to say which species arrived by themselves and which were brought by man. Archaeological evidence of prehistoric settlement in Finnmark dates back 10 – 12,000 years. A site with the highest concentration of Stone Age house grounds in western Finnmark was reported in the south-east of Sørøya Island (Vorren, 2005; Sunquist, 2011). Stone Age inhabitants of Sørøya were hunters, fishers and gatherers and had no domestic animals and pastures.

During the Middle Ages reindeer hunting intensified with use of trapping fences, where the reindeer were forced into a circular enclosure. Herds of domesticated reindeer were rather small. Common Yarrow (*Achillea*


*Cow Vetch (Vicia cracca) occurs in subalpine and alpine meadows of the Sørøya, spreading from the forage hay for cattle. Its occurrence is favorable to the plant community because, like other leguminous plants, it enriches the soil due to its nitrogen-fixing properties*


*Common Yarrow (Achillea millefolium) is used in official and traditional medicine as a diaphoretic, astringent, stimulant and healing for wounds*


*White Clover (Trifolium repens) was introduced as a pasture crop and occurs now in various disturbed habitats, often forming extensive creeping mats*


*Red Clover (Trifolium pratense) grows on subalpine and shore meadows of the island. It was introduced as a cattle forage, valued for its nutritional properties and ability to increase soil fertility*

*millefolium*) and Tufted Hair-grass (*Deschampsia caespitosa*) were reported as possible plants often found around Lapp huts and spread by reindeer along their trails.

With beginning of farms and villages on Sørøya in 19-20 century also came cattle herding and keeping, and a considerable number of weedy plants. Winter forage for the cattle was cut mainly from natural grassland, but weeds were introduced with cattle grain and hay from the mainland. Tufted Fetch (*Vicia cracca*), White Clover (*Trifolium repens*), Orchard Grass (*Dactylis glomerata*), Meadow Vetchling (*Lathyrus pratensis*) and Sneezewort (*Achillea ptarmica*) probably have been spread together with hay seeds.

The climate of northern Norway is unfavorable for cultivation of most crops. But cultivation of hay is regarded as a widely distributed technique of grasslands improvement in the north of Fennoscandia. Such grasses as Red Clover (*Trifolium pratense*) and Meadow Fescue (*Festuca pratensis*) have probably originated from cultivated forage crop.

Cultivation of vegetables and berries is rather common in villages and farms of Sørøya. Black and Red Currants (*Ribes nigrum* and *Ribes spicatum*), Strawberry (*Fragaria* x *ananassa*) and Rhubarb (*Rheum rhabarbarum*) are common in kitchen-gardens of northern Sørøya.

Gardening of ornamental plants is very popular everywhere in northern Norway: there are gardens around almost every village and farm houses. The gardens contain trees, shrubs, and perennial and annual ornamental herbs, which occasionally escape into natural habitats.

The practice of gardening, with the resulting movement of seeds, seedlings of introduced plants and soil facilitated immigration of weeds, such as Stinging Nettle (*Urtica dioica*) and Common Chickweed (*Stellaria media*) growing on moist nitrogen-rich soils around Sørøya settlements. The latter species grows abundantly on bunches of seaweed on the shore of some bays.

Some species of Hogweed (*Heracleum* spp.) are considered to have been introduced to northern Norway in the middle of XIX century

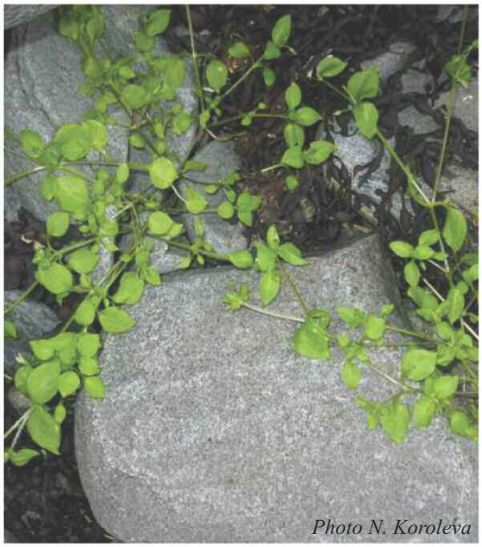

*Native plant Bird's-foot Trefoil (Lotus corniculatus) takes advantage from grazing, because it is light-loving and not preferential grass for feeding. It gets abundant and spreads more and more in grazed areas*

as exotic ornamental plants, and eventually spread to nearly every urban area. They flourish in almost every open space of Finnmark towns and villages and their surroundings. There are yet single and small localities of invasive Hogweed on the north of Sørøya but it is necessary to remember that it is considered as the most dangerous invasive species in Europe and not to plant it in the gardens.


*Rhubarb (Rheum rhabarbarum) is grown in kitchen-gardens of Sørøya primarily for its fleshy stalks, used for cooking. It persists near abandoned farm houses and 'runs' to brooks banks*

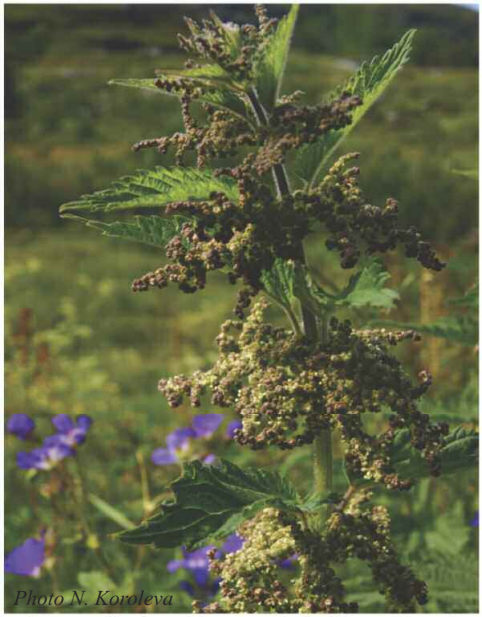

*Fireweed (Chamaenerion angustifolium) is among the commonest and conspicuous plants throughout all its blooming time from July into August. It grows anywhere along roadsides, springs, in meadows, but it is most striking and abundant in burned-over land, where it is one of the first plant pioneers to invade these inhospitable habitats. It is why it receives its name*


*Hogweed (Heracleum sp.) was planted in northern Fennoscandia as ornamental plant. Allelopathic features of Hogweed species were noted when its seeds inhibited germination and growth of some other plants in Petri dishes*




*Common Chickweed (Stellaria media) is common on seashores and near abandoned farm houses, on N and P rich habitats*


*Common Sorrel (Rumex acetosa) is a typical plant of grasslands, fields and pastures. It is considered (as well as Meadow Buttercup) to accompany Stone Age human settlements*




*Stinging Nettle or Common Nettle (Urtica dioica) occurs in moist and rich habitats near settlements. It has a long history of use as a medicine, food and textile plant*


*English Cowslip (Primula veris) is popular cultivated ornamental plant, which leaves can be used in salad. It occurs on Sørøya on the brook banks near settlements*


Bryophytes
Photo N. Koroleva

# Bryophytes of Northern Sørøya

Bryophytes are major groups of green non-vascular land plants. They have a gametophyte-dominant life cycle, in which cells of the plant carry only a single set of genetic information. Following modern systematic of plants, **hepatics** (or **liverworts), mosses** and **hornworts** are separate groups within the Plant Kingdom.

**Mosses** are plants that possess both stems and leaves. The leaves normally have a nerve or midrib and usually are spirally arranged round the stems. Mosses do not have roots like those of higher plants but instead have root-like threads or rhizoids that attach the plant to the substratum. There are about 14000 species of moss worldwide.

**Liverworts** count about 5000 - 6000 species which are distributed from tropics to the Arctic. The name "hepatic" comes from the Latin-name for liver *hepatic*, and refers to the thallose form, which was thought to resemble a liver or perhaps to be a cure for liver ailments. This led to the more common English name, liverwort, literally «liver plant». Liverworts are cousins of mosses and are sometimes mistaken for them (or in their thallose forms for lichens). In general, liverworts tend to prefer moister habitats than mosses (though some can grow in quite dry places) and are less common, at least in Sørøya Islands. Liverworts come in two very distinctive forms - **leafy** and **thalloid**. Leafy liverworts are clearly leafy, and look very much like mosses. Thalloid liverworts, on the other hand, do not look like mosses. Leafy liverworts outnumber the thallose liverworts in nature, but some guide-books mostly focus on the biology of thallose liverworts. Moreover, most books use


*Bucklandiella microcarpa grows on acidic rocks, boulders and cliffs, as well as on soil or gravel. It is often found in snow-beds communities, mostly in exposed, dry or moist sites on the Sørøya*


*Fringe-moss or Heath Grey Moss (Racomitrium lanuginosum) is widely distributed. It prefers acidic or occasionally calciferous soil and rocks, boulders and polar tundra. In the island it usually grows on dry, exposed, open areas. This is due to the very long hyaline awns that at once separate it from all other allied species – it often has a hoary appearance due to their long, hair-pointed leaves*


*Marchantia polymorpha is polymorphic species and consists of three subspesies – M. p. montivagans, M. p. polymorpha and M. p. ruderalis. First on these is one of the largest thallose liverworts, which grows on base-rich wet rocks, sometimes nearby streams. Thalli are pale or yellowish-green when young, but become brown or purplish when old. On the picture it is together with Spiral Apple-moss (Philonotis seriata)*


*Mountain Pincushion (Hymenoloma crispulum) is wider known under the name Dicranoweisia crispula. It forms green to dark green cushions to 3 cm tall. The moss usually occurs in relatively exposed sites and is tolerant to a variety of rock chemistry, but is most frequent on at least moderately Ca-rich rocks*

common liverwort or umbrella liverwort (*Marchantia polymorpha*) as an example of thallose liverwort, but among them, Marchantia is not very typical.

Bryophytes (including liverworts) occupy an important ecological niche. Like other green plants, they convert carbon dioxide and water into oxygen and carbon compounds by the process of photosynthesis. Many bryophytes serve as soil stabilizers in disturbed sites or as depository for germination of higher plants.

Because of their small size and relative infrequency, the mosses and liverworts tend to be less known, even by knowledgeable biologist, than the larger plants. For those who want to seek them out with help of a powerful hand lens, they hold many surprises. Their complexity, diversity and beauty make them fascinating objects of study.

On the Sørøya Island mosses and liverworts can be found in various habitats: on exposed cliffs and rocks, along stream banks,in bogs and swamp, in tundra and even along roadside ditches or in your own garden. They largely reflect the microscale environmental conditions, especially microclimate, soil development and chemical composition of the substrata.

A large portion of the alpine zone on Sørøya Island is occupied by extensive bare


*Juniper Haircap (Polytrichum juniperinum) is a small fir-like moss, which is abundant in dry and snow-free habitats, frequently as a pioneer on burnt places and disturbed soils in alpine and subalpine zones*


*Yellowish- or pale-green patches of liverwort Odontoschisma macounii grow on peaty fine earth on wet calcareous rocks. More often this species occurs as singular shoots among other bryophytes*

Sørøya Island is occupied by extensive bare rocks where open bryophytes communities are widespread. Large stones or dry rocky are occupied by scattered mats, small cushions and short turfs of mosses *Andrea rupestris, Schistidium* spp. and *Racomitrium* s.l.

Wet rocky substrata are favorable for many bryophytes. *Pohlia cruda*, *Barthramia ithyphylla, Plagiothecium denticulatum* together with *Gymnomitrion concinnatum* and *Diplophyllum taxifolium* grow in the moist rock crevices and hollows. *Bryum* species prefer fine earth on rocky ledges.

Closed mountain birch forests and even scattered birches have a profound influence on microclimate under their crowns affecting cryptogamic vegetation. Even a closed layer of dwarf shrubs forms a microclimate, which differs from open soil. Bryophytes form a dense closed thicket under a coppice of mountain birches, junipers and heath in subalpine and lower alpine zone where species such as *Hylocomium splendens*, *Pleurozium schreberi*, *Polytrichum* spp. and *Ptilidium ciliare* are very


*Stepped Moss or Glittering Wood-moss ( Hylocomium splendens) is one of the most well known among the mosses. It is common and may be abundant amongst grass and heather on heathland on terrains, in subalpine and alpine zone. Whilst usually occurring in acidic habitats, it may sometimes be found on calcium-rich rocks*

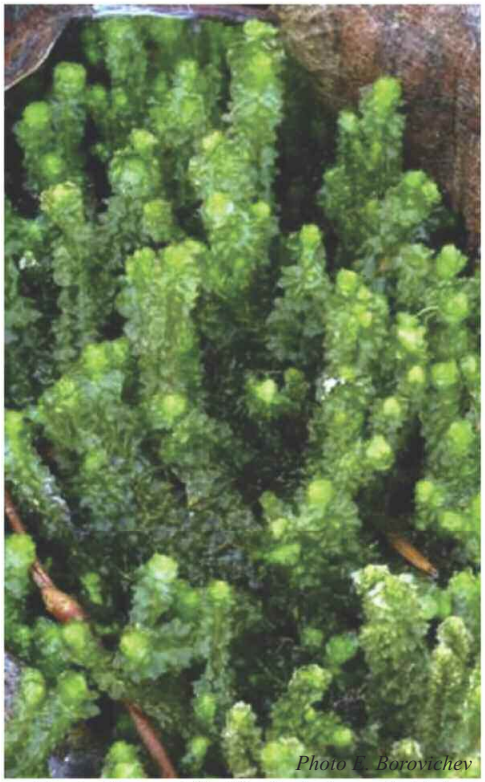
common. Liverworts such as *Barbilophozia spp., Neorthocaulis floerkei, Shljakovia kunzeana* find protection in thick carpets of moss.

Wetlands on Sørøya support extensive closed communities dominated by mosses and liverworts (*Sphagnum* spp., *Aulacomnium palustre, A. turgidum, Mylia anomala,* etc). Sphagnum mosses prevail here and contribute, together with other wetland species, to formation of peat. Sphagnum mosses are considered to provide a special environment for other species which have to endure acidity, coldness and permanent "shifting up" of the Sphagnum peat as a substrata.

Communities nearby snow patches in high alpine zone are rich of bryophytes. Plants here have to endure condition of short growth season, unstable and often waterlogged substrata. Species *Kiaeria starkei, Racomitrium sudeticum, Marsupella* spp., *Pleurocladula albescens, Anthelia juratzkana* can be found there. Often snow-bed moss species grow on wet exposed soil banks.


*Earwort (Diplophyllum taxifolium) forms green to greyish-green or yellowish-brown turfs or mats, rarely occurs as single plants among other bryophytes. The species is a pioneer on shaded caves or rock walls and crevices. It is often found on bare soil, peat, boulders and rock faces*


*Species of genus Bryum are of most difficult to identify. They often colonize degraded soils and exposed rocks which are unsuitable for other plants. That is why they are called "pioneer species"*




*Greater Pawwort (Barbilophozia lycopodioides) grows in loose depressed, pale- to yellow-green tufts, sun-exposed plants are slightly brownish. It is often it is locally abundant on mossy boulders and in turf on north-facing slopes. It usually prefers some shelter, such as in well-drained habitats at the bases of rock walls, cliffs, and steep ledges. It also grows on fine earth in tundra*



*Ciliated Fringewort (Ptilidium ciliare) grows in greenish to yellow- or olive-green patches, sometimes with reddish-brown secondary pigmentation, and often forms large mats on exposed substrata or occurs mixed with other bryophytes. It tolerates some desiccation, and grows in various habitats such as rocky slopes, screes, tundra, mountain birch forest and bogs*


*Tumid Notchwort (Lophozia ventricosa var. longiflora) is very variable and common species – green to yellow-green, often with brownish or reddish secondary pigmentation, with prostrate or ascending shoots, with numerous yellow-green or pure-green gemmae. The species grows in shadowy, more or less moist places, sometimes among Sphagnum or other bryophytes*


*Snow Threadwort (Pleurocladula albescens) is a small liverwort of white or greyish-green (sometimes bright green) color, which grows in tough tufts or amidst other bryophytes. Its leaves are tiny, but with a hand lens they can be seen to be rounded, deeply concave and distinctly bi-lobed. Small, egg-shaped leaves lie hidden on the underside of the stem. The species is very characteristic for snow-bed habitats, sometimes it also grows on stony slopes*


*Woody Feather-moss (Tomentypnum nitens) grows in short tufts in eutrophic fens as well as in wet tundra communities mainly on calcareous and base-rich substrata*


*Gymnomitrion corallioides forms silvery or whitish-grey when dry intricate tufts of densely growing shoots, sometimes at apex with a brownish intramarginal zone of leaves. It prefers fine earth patches on exposed rock walls and windswept rocks*

*Rigid Bog-moss (Sphagnum teres) is one of common Sphagnum species growing on eutrophic fens and transition mires with relatively high nutrients content. Conspicuous apical bud and brown stem are very good field characteristics for the species*



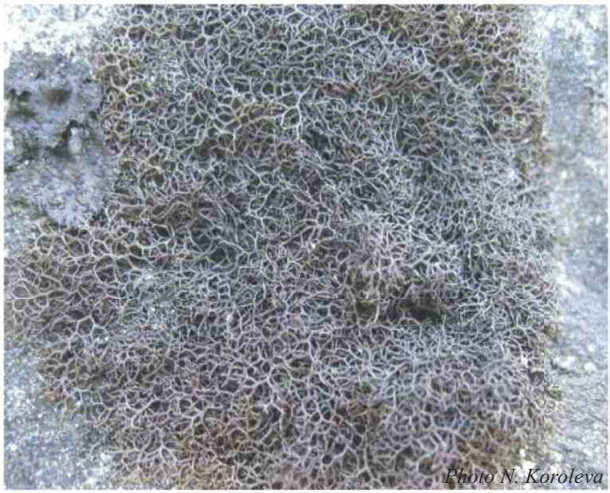
*Spiky Bog-moss (Sphagnum squarrosum) is one of characteristic Sphagnum-species. The plant is robust and stiff and the color vary from green to yellowish green. It has large «head», with conspicuous apical bud and squarrose leaves. The species is minerotrophic and it grows most common in coniferous fens*


*Warnstorf's Bog-moss (Sphagnum warnstorfii) is small, slender and lax Sphagnum-species. It can be red thought when growing exposed to strong light. When growing in more higher pH conditions the colour may be bluish. It grows in medium to rich fens*


*Lichen Parmelia saxatilis resembles a leaf in shape and is common on base-poor rocks*

# Lichens

Lichens are a puzzling group of organisms. Literally, they represent 'mini-ecosystems' which consist of two separate organisms - fungus and a photosynthetic partner growing together. The lichen thallus is a **symbiotic formation** composed of a **photobiont or** phycobiont consisting of cells of green algae, commonly *Trebouxia* and\or blue-green algae, commonly *Nostoc*, and a **mycobiont** fungus.




*Fruticose lichen Pseudephebe pubescens grows on the exposed siliceous rock*

Lichens vary in colour, from nearly white to tints of gray or brown, red, orange or yellow. The most brightly colored lichens are usually to be seen on rocks or tree bark in open sunny habitats. Color of lichens is thought to be of importance in regulating temperature, since certain pigments scatter or reflect radiation from the sun protecting the sensitive algae layer, and keeping the lichen body cooler (Brodo et al., 2001).

Lichens comprise a very important part of subarctic and arctic ecosystems. They are often the first organisms to colonize exposed rocks high in mountains and in tundra zone. They start the slow process weathering barren rocks and incorporating minerals into their bodies. This makes nutrients available to other forms of plant life. Lichens occur on various substrata, on the surface of bark, stone, fine earth, etc.

Individual lichen can be more than a thousand years old. Lichens are remarkably resistant to changes in environmental conditions and can remain dormant for long periods if conditions are not favorable for their growth.

No one knows for certain how many lichen species there are on Earth, estimates vary from 13500 to 30000 species (Purvis, 2010). It is not difficult to discover new records and species of lichens even in comparatively well studied regions, for example – in the north of Europe. The Norwegian lichen flora is probably one of the best studied in the world. They have recorded 1985 species (Timdal et al., 2010) however, the lichen flora of the Sørøya Island has not been properly investigated.

To read about lichens one need to know some special terms concerning morphology and biology of lichens. **Thallus** is the lichen body. Thallus is attached to its substratum by short root like organs called


*Tremolecia atrata, one of the commonest epilithic crustose lichens of the Sørøya Island*


*Foliose lichens of genus Peltigera mainly occur on soil, but can grow on rock, tree bark, and on mosses*

**rhizines**. **Cortex** is «tissue» consisting of fungal filaments and an algal layer located inside the thallus where the algae cells are enclosed in a hard but loose network of the fungal filaments. The thallus may contain fruiting bodies: **apothecia** which are open fruiting bodies containing fungal spores; **perithecia** – the same as apothecia, but closed; **cephalodia** - containing blue-green algae. The lichen thallus has organs of vegetative reproduction – **soredia**, which represent clumps formed by algae cells and fungal filaments which can break away from the thallus and after being transported by wind or water, grow as a new thallus. Clusters of soredia are named **soralia. Isidia** is the same organ as soredia, but covered by the cortex.

All lichens may be separated into following major groups based on morphology of the thallus. **Foliose** lichens are leaf-like, composed of lobes and relatively loosely attached to the substrate, usually by rhizines. Their lobes have upper and lower sides and usually grow more-or-less parallel to the substrate. **Umbilicate** lichens are attached to the substrate only at a central point. **Fruticose** lichens are looking like tiny shrub, their branches are generally not flat in cross-section but mostly three-dimensional. **Crustose** lichens form crusts that are so tightly attached to the rocks, bark of shrubs or soils that they can't be removed without damaging the substratum.

Basing on substrata lichens are growing upon, they are subdivided into **epiphytes**, which are living on other plants, **epigeous** lichens, which occur mainly on the soil and fine earth, and **epilithic** lichens, which grow on the rock surface. Crustose lichens even can grow immersed in rocks with only their fruiting bodies above the surface. It should be emphasized, that these lichen substrata groups and growth forms do not represent taxonomic groups and include various different taxonomic groups.


*Xanthoria parietina is a widely distributed foliose lichen which grows on nutrient-rich substrata: on sea rocks and inland below bird perching areas*

## Lichens on the littoral

There are only a few dozen species among about 20 000 known lichens that grow always or periodically submerged by sea water. They are true halophytic and marine species which never occur outside the littoral area and are widely distributed on seashores almost everywhere in the world. In general they belong to genus *Verrucaria* and are easily distinguished from free-living algae by the dark perithecia.

*Photo A. Melekhin*

*Photo A. Melekhin*

*Verrucaria striatula (dark thallus) and Verrucaria mucosa (olive-green thallus) on stones among Common Barnacles (Balanus balanoides)*

## Lichens on upper geolittoral

Lichens here are not flooded but during storms they are exposed to the action of waves and sea spray, and sometimes get covered by the high tidewater. Moreover, these habitats and lichens often are fertilized by birds' droppings and it's why they are called "ornithophilous". Lichens-specialists of upper geolittoral rarely occur at some distance from the shore in habitats visited by birds; among them, *Amandinea coniops* and *Xanthoria elegans* are the commonest.



*Caloplaca microthallina (yellow) and Verrucaria maura (black)*


*Lecanora actophila occurs in holes in stone*


*Lecanora poliophaea is rarer in the Sørøya than the previous species*

## Coastal lichens

Some lichens growing on the coast are rare inland, though they can occur inland more often, than species from the upper littoral. They aren't exposed to the direct influence of sea water, but the air is often humid with a high salt content; often they occupy dry mobile sand and use other plants as substrata.



*Solorina bispora grows on well lit moss tufts*


*Fulgensia bracteata grows under the cover of mosses on sand with shells*

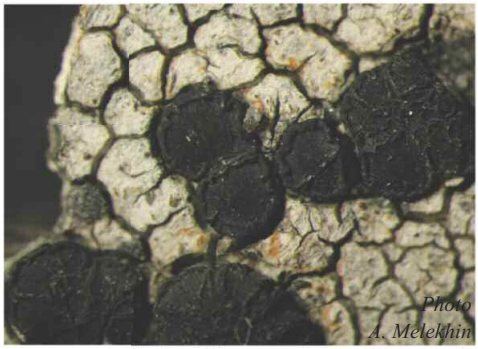

*Gyalecta foveolaris occurs on mosses in caves, well protected from direct light and water*

## Lichens of the seashore grasslands

Lichens cannot compete with grasses on the coastal grassland; it is why they as a rule grow here only on large boulders and rocks. But with the help of a hand lens one can find the small thallome of *Collema* and *Leptogium* species in tufts of grasses, on the soil and litter. These lichens together with free-living cyanoprocaryota enrich the soil with nitrogen and increase productivity of grassland ecosystems.



*Protoparmelia badia is one of the most easily recognizable lichens which have a cracked thallus*

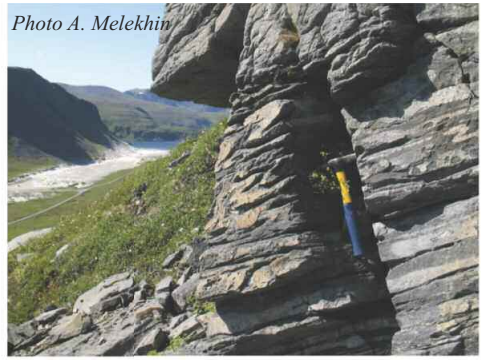



*Lecidea lapicida (lapicida means "devouring stone") destroys the rock surface to a depth of a few millimeters*


*Tephromela atra is easily recognizable species: it has contrasting apothecia with a black disk and the white edge. On the right side of picture is Parmelia omphalodes*

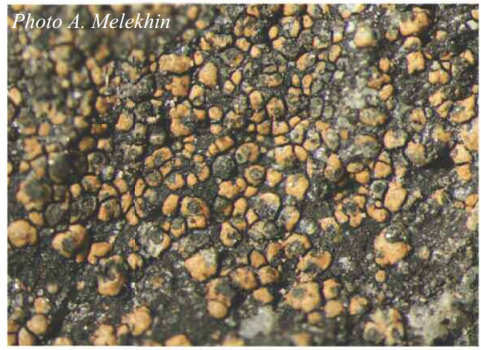
## Lichens of cliffs

Cliffs provide the highest diversity of lichen biota everywhere in the world. Along sea cliffs in Sørøya and often ascending to a height of 50 meters there is high lichen diversity. Almost all species which occur in tundra and birch forest of the Sørøya can be found on the cliffs, although some of lichens grow exclusively in these rocky habitats.





*Protopannaria pezizoides grows on mosses growing on fine earth along rock ledges*




*Miriquidica atrofulva on a vertical rock wall*


*Placynthium asperellum on calcium-containing rock, together with Protopannaria sp. which uses cyanoprocaryota as photobiont*

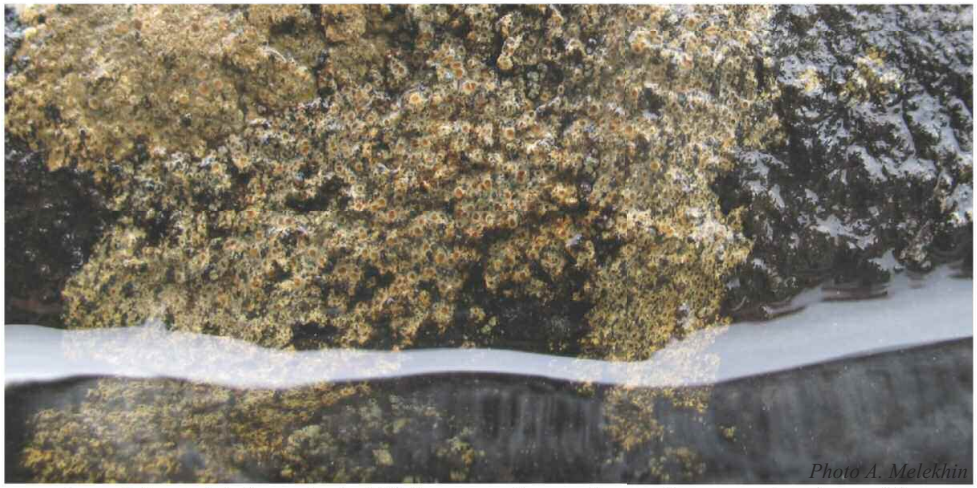
## Lichens of freshwater reservoirs

In streams, pools, lake shores and on temporarily or permanently wet cliffs, there are lichens specialists, which are ecologically similar to the species growing in the seashore littoral habitats. Fresh-water lichens normally cannot be found in eutrophic and polluted water and prefer conditions of flowing water current.



*Ionaspis odora (brown on the picture) has a pleasant smell. Nearby is Catillaria chalybaea (bulging with black apothecia) and Aspicilia aquatica*

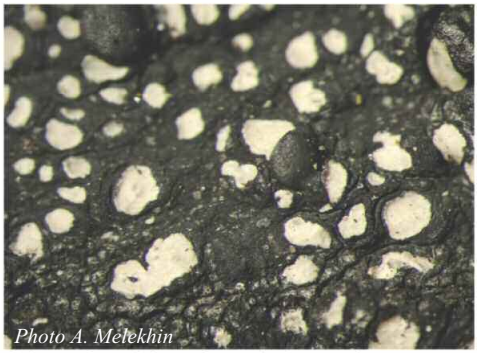

*Water- and shade-loving lichen Lecidea phaeops on the cliff*




*Ionaspis lacustris is the most colorful lichen among the aquatic ones; it grows on stone in a puddle*

## Species of screes

Moving sloping screes are covered primarily by crustose lichens. Other forms of lichens have difficulty surviving in these habitats. Screes offer an opportunity to observe soil formation and plant succession, after pioneer species of lichens destroy the rock surface by physical and chemical activity (hyphae of the lichens go through the stone particles and lichen acids dissolve them). They produce a thin layer of primary soil, in time their descendants carry on and make the soil layer thicker. Epilithic lichens are essential for the development of primary soil and first stages of plant cover.


*Calvitimela melaleuca has a thick crust that protects it from the harsh environment*


*Porpidia melinodes on a boulder*

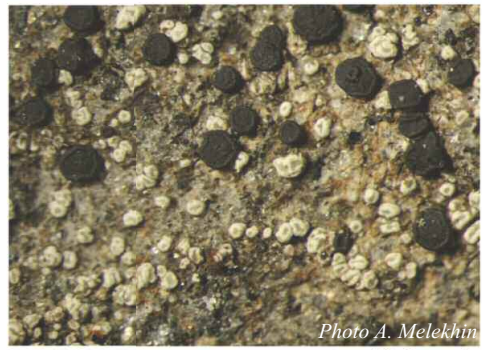

*Placopsis gelida is a lichen which consisted of three types of organisms: fungus, green and blue-green algae (producing brown cephalodia in the center of the thallus)*

## Snowbed lichens

A few species can survive near snowfields, where they flourish apparently due to the absence of the competitors. Their development is limited only by duration of snow cover and short growing season. *Stereocaulon* species are the most characteristic lichens of snowbed habitats.



*Pertusaria oculata grows on branches of mosses and other plants*




*Stereocaulon tornense – a rare crustose life form of genus Stereocaulon (most of the Stereocaulon-species are fruticose lichens)*


*Frutidella caesioatra grows on epilithic mosses*

## Lichens in tundra

Habitats in the upper part of the alpine zone are cold in summer and snow-free in winter. Here is the "lichens paradise", where lichens can dominate in the plant cover, and their diversity is much higher compared to vascular plants. Though most lichens are known to grow very slowly, some *Cladonia* and *Flavocetraria* species can increase in size up to 1 cm per year. *Cladonia, Cetraria* and *Stereocaulon* species are among the most favorable lichens in reindeer' winter ration.



*Solorina crocea on deflated soil. It has orange underneath and various colors (from light-green to olive-brown) on the upper surface*


*Thamnolia vermicularis looks like 'spaghetti' for reindeers*


*Ochrolechia frigida often grows on mosses and on alive or dead twigs*

## Lichens on trees and shrubs

Trees and shrubs are covered by epiphytic lichens. More often lichens occur on the trunk base and on epiphytic mosses. Epiphytic lichens are not very diverse and abundant in the northern part of the Sørøya Island because of low proportion of trees and harsh winter conditions for living of epiphytes.



*Parmeliella triptophylla on the bark of Mountain Ash (Sorbus aucuparia ssp. glabrata)*


*Biatora globulosa on the bark of Mountain Ash, sometimes it grows on wood without bark*


*Mycobilimbia tetramera on mosses at the trunk base of Mountain Ash*

## Lichens of grazed habitats and along trail ways

Here macrolichens are trampled and eaten by reindeers and sheep, but surprisingly it leads to increasing lichens biodiversity in general. Fast-growing fruticose and foliose lichens readily recover the areas after moderate trampling and scattering their pieces around. In open patches of soil between tufts of grass, pioneer lichens settle very nicely.



*Cladonia uncialis was chewed almost completely, but after a few years it will recover again*


*Stereocaulon condensatum is a frequent pioneer species of recently disturbed soil*


*Peltigera aphthosa: the upper (light-green, with apothecia) and lower (with black rhizines) sides of the thallus*

## Lichens growing along roadsides

Arctic and subarctic ecosystems are changing catastrophically because of road and pipeline construction. Pioneer, fast-growing lichens settle on the open soil and quickly colonize large territories, but rare species often disappear from the disturbed areas.



*Baeomyces placophyllus usually grows on deflated soil in the tundra and quickly colonizes roadsides*


*Stereocaulon alpinum forms extensive mats along roadsides*


*Stereocaulon glareosum is a pioneer species differing from the other Stereocaulon species by large, up to 5 mm, cephalodia (beige lumps) with a blue-green algae (Nostoc spp.)*

# General index of plant and lichen names

**Bryophytes**

**Lichens**

# Conclusion

This guidebook is a brief and colorful introduction to the stunning landscapes, flora, fauna and geology of Sørøya Island. Watching northern wildlife with your own eyes can be an unforgettable experience, made even more interesting if you understand something of the environment and ecology. The guide is designed to help with your own exploration of the Sørøya Island, for example it's hidden treasures in the miniature wonderlands of lichens and mosses and their combinations with plants into diverse and sometimes, unique ecosystems.

Doing walks around the Sørøya Island, taking pictures of tiny pretty flowers or great magnificent landscapes will bring you to a new level of knowledge about nature in it's so different appearances. Just grab your walking gear and camera - the Sørøya Island is there to welcome you!..


*Small village Akkarfjord has boat connection with Hammerfest*