

F1.2 Moss and lichen tundra

Summary

Moss and lichen tundra is a naturally treeless habitat restricted to areas with permafrost, confined in the EU28+ to subarctic Iceland, Svalbard, Jan Mayen and Bjørnøya. It is typically found on acidic to neutral sedimentaries or younger volcanic rocks in the lowlands and along the coast, though the relief is very variable. The vegetation is dominated by extensive deep moss carpets with scattered dwarf shrubs, sedges and herbs, the composition varying with soil type and snow cover. Freeze-thaw can produce patterned ground and vegetation mosaics. With climate change, the future is uncertain.

Synthesis

Based on few quantitative data in combination with expert knowledge, the habitat 'Moss and lichen tundra' is assumed not to meet any threshold of the criteria of the Red List, resulting in an overall assessment of Least Concern (LC). Many of the subcriteria are indicated as 'Data Deficient'.

Overall Category & Criteria			
EU 28		EU 28+	
Red List Category	Red List Criteria	Red List Category	Red List Criteria
-	-	Least Concern	-

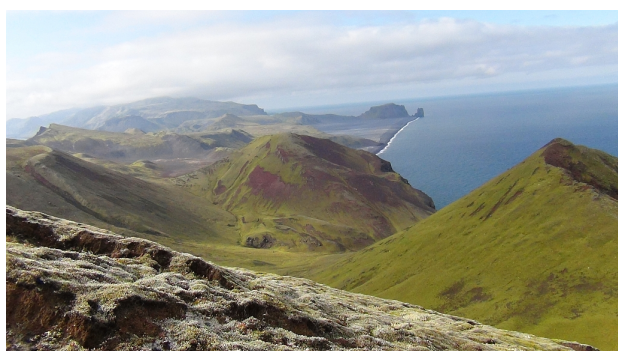
Sub-habitat types that may require further examination

A main division would be in the true, species-rich moss and lichen tundra of Svalbard, and the - rather distinctive - *Racomitrium* dominated volcanic fields of Iceland and Jan Mayen. It is likely that - with present data - both subtypes would be assessed as Least Concern.

Habitat Type

Code and name

F1.2 Moss and lichen tundra



Racomitrium lanuginosum dominated tundra at the arctic island Jan Mayen, Norge (Photo: Maarten Loonen).



Moss and lichen dominated tundra at Bohemanneset, Svalbard (Photo: Jutta Kapfer).

Habitat description

Moss and lichen tundra is a naturally treeless habitat restricted to areas with permafrost and characterized by a relatively thick and dense cover of mosses. Mean annual temperatures range from -7 to -1 °C. More important for the growing period of vegetation, which only starts in early summer, are the mean July temperatures, ranging from 2-3 °C in the north to 4-6 °C in the middle-arctic zone. Average annual

precipitation is between 200 and 800 mm.

In Northern Europe, the habitat type is typically found in the lowlands and along the coast on acidic to neutral Mesozoic and Paleozoic bedrock (Svalbard, Bjørnøya) with *Tomentypnum nitens* and *Warnstorfia sarmentosa* as dominating species, while *Racomitrium lanuginosum* dominates on neutral to alkaline younger volcanic rocks (Jan Mayen, Iceland). The relief varies considerably. More eastwards in northern Russia the habitat occurs mainly in a flat or slightly hilly landscape. Permafrost leads to micro-patterns with slightly different relief within the habitat.

Characteristic vascular plants in Moss and lichen tundra are the dwarf shrubs *Dryas octopetala* and *Cassiope tetragona*, and *Salix herbacea* and *S. polaris* (in respectively neutral to alkaline and acidic snowbed-like, moist-soils), the sedges *Carex rupestris*, *C. nardina*, *C. misandra*, and *Luzula arctica* (on neutral to alkaline soils), as well as *Luzula confusa* (on acidic soils) and *Saxifraga oppositifolia*. While the vascular flora of the arctic region is relatively species poor, high numbers of lichens, mosses and fungi may be found. The species composition varies with changes in bedrock (alkaline - acidic), soil type (rocky to mesic), snow-cover and exposition.

On Svalbard four main types of Moss tundra may be distinguished: (1) Wet Moss tundra on calcareous bedrock, dominated by *Tomentypnum nitens*. (2) Dry Moss Tundra on calcareous soils with dominance of *Dicranum angustum*, (3) acidic Moss tundra with *Polytrichum strictum*, and (4) Wet Moss tundra on acidic bedrock dominated by *Sphagnum squarrosum*. Typical lichens of this tundra habitat are *Cetrariella delisei* (dominant on stony sites), *Cladonia mitis*, *Cetraria nivalis* and *Sphaerophorus globosus* (on acidic substrates). On Iceland, in the subarctic region, species-poor *Racomitrium lanuginosum* dominated habitats occur on relatively old lava. Such habitats are locally called 'moss heath' but are included here in 'Moss and lichen tundra'. Vascular plants in these moss fields are heathland species, like *Carex bigelowii* or *Empetrum hermaphroditum*. The arctic island Jan Mayen is largely dominated by moss beds of *Racomitrium lanuginosum* and *R. canescens*, while – less frequently – also *R. fasciculare* occurs in this habitat. Here, very few plants are able to germinate in this moss tundra, that is only more open in places where it has been eroded, like on steep slopes. The habitat is found on dry slopes, but also on more foggy slopes.

Transitions occur towards more sparsely vegetated polar deserts (habitat H5.1b) in dry areas, tundra mires (habitat D4.2 with *Deschampsia alpina*, *Carex stans* and *Eriophorum scheuchzeri*) in wet locations, snow beds (habitat E4.1 and F2.1) in hollows and depressions with long lasting snow cover (dominated by *Poa alpina* and *Salix reticulata*), sparsely-vegetated stony riverbeds in valleys (habitat C3.5d), communities with different *Potentilla* species on screes (habitat H2.1 and H2.2), and shrub tundra with heathland species (F1.1) on Iceland.

Moss and lichen tundra is a circumpolar habitat type within the arctic regions of Russia, Canada, Alaska and Greenland. In the EU28+, the middle and northern arctic zone is limited to the Svalbard archipelago and to the islands of Jan Mayen and Bjørnøya. On Svalbard it is limited to a relatively small percentage of the total area, as the largest part is covered by glaciers or polar desert (type H5.1b). Additionally the habitat covers parts of Iceland, in the subarctic region. In addition to permafrost, moss tundra on Svalbard depends on the natural fertilizers birds and Svalbard reindeer. The typical Moss tundra can be found under bird cliffs but it is common in all parts of the north-arctic tundra zone on Svalbard.

Indicators of quality:

In good conditions the habitat shows the following characteristics:

- Very low cover of (dwarf) shrubs,
- Diversity of microhabitats due to frost patterns (polygons) and cryoturbation
- High diversity in mosses and lichens
- Absence of human disturbance

Characteristic species:

Vascular plants: *Campanula uniflora*, *Carex bigelowii* subsp. *ensifolia*, *Carex misandra*, *Carex nardina*, *Carex rupestris*, *Cassiope hypnoides*, *Cassiope tetragone*, *Cerastium nigrescens* subsp. *arcticum*, *Deschampsia alpina*, *Dryas octopetala*, *Hierochloë alpina*, *Luzula arctuata*, *Luzula confusa*, *Pedicularis dasyantha*, *Salix herbacea*, *Salix polaris*, *Saxifraga oppositifolia*, *Silene acaulis*

Mosses: *Aulacomnium turgidum*, *Dicranum elongatum*, *Encalypta alpina*, *Hylocomium splendens*, *Polytrichum* species, *Pseudocalliergon turgescens*, *Racomitrium ericoides*, *Racomitrium lanuginosum*, *Sanionia uncinata*, *Tomenthypnum nitens*

Lichens: *Cladina mitis*, *Cetraria nivalis*, *Cetrariella delisei*, *Lecidea ementiens*, *Ochrolechia frigida*

Classification

This habitat may be equivalent to, or broader than, or narrower than the habitats or ecosystems in the following typologies.

EUNIS:

F1.2 Moss and lichen tundra

EuroVegChecklist (alliances):

Kobresio-Dryadion Nordhagen 1936 (= *Caricion nardinae* Nordhagen 1935) (on basic/neutral soils)

Luzulion arcuatae Elvebakk 1985 (included in *Ranunculo-Oxyrion didynae* Nordhagen 1943) (on acidic soils)

Racomitrium lanuginosi Krusenstjerna 1945 (cryptogamic community)

Annex 1:

--

Emerald:

--

MAES:

Heathland and shrub

IUCN:

3.1. Subarctic shrubland

Does the habitat type present an outstanding example of typical characteristics of one or more biogeographic regions?

Yes

Regions

Arctic

Justification

The habitat is the typical and dominating habitat of the Arctic biogeographical region

Geographic occurrence and trends

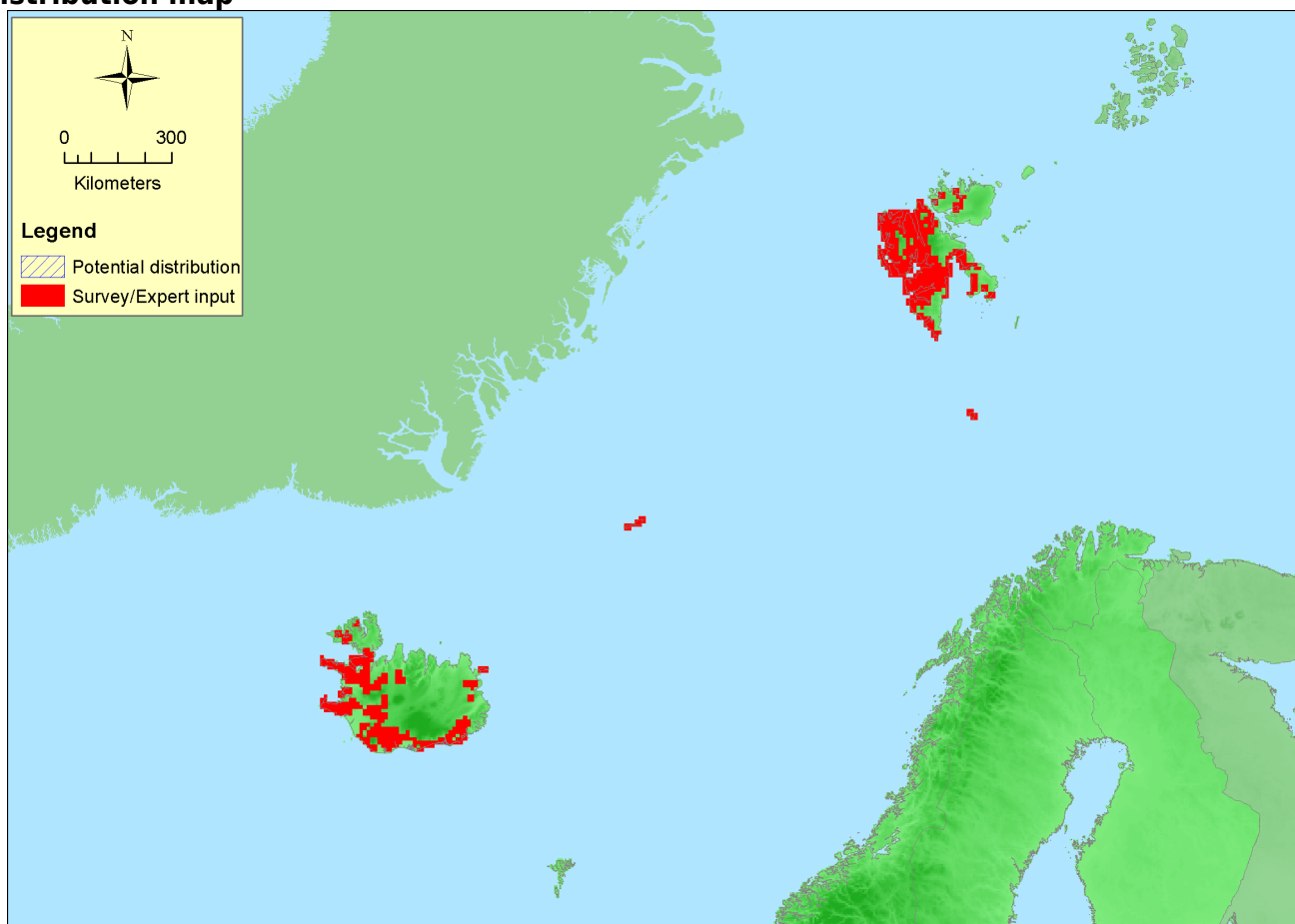
EU 28	Present or Presence Uncertain	Current area of habitat	Recent trend in quantity (last 50 yrs)	Recent trend in quality (last 50 yrs)
-------	----------------------------------	----------------------------	---	--

EU 28 +	Present or Presence Uncertain	Current area of habitat	Recent trend in quantity (last 50 yrs)	Recent trend in quality (last 50 yrs)
<i>Iceland</i>	Present	unknown Km ²	Unknown	Unknown
<i>Norway</i>	Jan Mayen: Present Svalbard: Present	740 Km ²	Stable	Stable

Extent of Occurrence, Area of Occupancy and habitat area

	Extent of Occurrence (EOO)	Area of Occupancy (AOO)	Current estimated Total Area	Comment
<i>EU 28</i>	- Km ²	-	- Km ²	Not occur in EU28, only at Svalbard and Jan Mayen
<i>EU 28+</i>	828 Km ²	1171700	>740 Km ²	The EOO is less than 50000 km ² but there are no decline

Distribution map



The map rather complete, based on the potential vegetation which is similar to actual vegetation for this habitat. Data source: BOHN.

How much of the current distribution of the habitat type lies within the EU 28?

0%. The habitat does not occur in the EU28.

Trends in quantity

Over time the habitat probably is stable in trend of quantity. With the foreseen climate change it will increase in area where presently glaciers and polar desert occur, and decrease in area in other sites due to competition from Arctic shrub tundra (F1.1).

- Average current trend in quantity (extent)

EU 28: -

EU 28+: Stable

- Does the habitat type have a small natural range following regression?

No

Justification

It has a relatively large EOO and it is not sure that it is declining.

- Does the habitat have a small natural range by reason of its intrinsically restricted area?

No

Justification

The habitat does not occupy a small area.

Trends in quality

The habitat is probably stable in quality over the last decades.

- Average current trend in quality

EU 28: -

EU 28+: Stable

Pressures and threats

In the future climate change will affect the habitat but it is hard to tell in what way. The most likely scenario will be a northward shift of the vegetation belts, but it will be a very slow process. It is unclear whether the reduction due to shrub encroachment and a possible increase in unvegetated glaciers and polar deserts will result in a stable trend in future or a declining or increasing trend.

List of pressures and threats

Climate change

Changes in abiotic conditions

Temperature changes (e.g. rise of temperature & extremes)

Changes in biotic conditions

Habitat shifting and alteration

No threats or pressures

No threats or pressures

Conservation and management

No measures needed at the moment. If there will be changes because of changing climate, it is hard to do anything.

List of conservation and management needs

No measures

No measures needed for the conservation of the habitat/species

Conservation status

No related Annex I types.

When severely damaged, does the habitat retain the capacity to recover its typical

character and functionality?

This is one of the most stable and still natural habitats in Europe. As arctic processes occur very slow, the time for recovery after destruction is extremely long.

Effort required

200+ years
Naturally

Red List Assessment

Criterion A: Reduction in quantity

Criterion A	A1	A2a	A2b	A3
EU 28	- %	- %	- %	- %
EU 28+	0 %	unknown %	unknown %	unknown %

Few quantitative data are available, but there are no indications of negative trends in the last 50 years. The conclusion for criterion A1 therefore is Least Concern. For the future impacts from climate change are expected, but it is unclear how these will work out.

Criterion B: Restricted geographic distribution

Criterion B	B1				B2				B3
	EOO	a	b	c	AOO	a	b	c	
EU 28	- Km ²	-	-	-	-	-	-	-	-
EU 28+	30000 Km ²	No	No	No	>50	No	No	No	No

No decline is known for the habitat, there are many sites, and the EOO and AOO are too large to meet the thresholds of criteria B1, B2 and B3. The conclusion therefore is Least Concern.

Criterion C and D: Reduction in abiotic and/or biotic quality

Criteria C/D	C/D1		C/D2		C/D3	
	Extent affected	Relative severity	Extent affected	Relative severity	Extent affected	Relative severity
EU 28	- %	- %	- %	- %	- %	- %
EU 28+	0 %	0 %	unknown %	unknown %	unknown %	unknown %

Criterion C	C1		C2		C3	
	Extent affected	Relative severity	Extent affected	Relative severity	Extent affected	Relative severity
EU 28	- %	- %	- %	- %	- %	- %
EU 28+	unknown %	unknown %	unknown %	unknown %	unknown %	unknown %

Criterion D	D1		D2		D3	
	Extent affected	Relative severity	Extent affected	Relative severity	Extent affected	Relative severity
EU 28	- %	- %	- %	- %	- %	- %
EU 28+	unknown %	unknown %	unknown %	unknown %	unknown %	unknown %

No trends over the last 50 years are known, but impacts are expected from climate change. It is uncertain in what amount and with what severity these will affect the quality of the habitat. In the Norwegian Red List of Ecosystems the subhabitat "High Arctic Bird Cliffs" (of which the meadow-part may be considered part of the broader unit Moss tundra) has been assessed as Vulnerable under criterion "reduced state", because of a decline in sea-bird populations.

Criterion E: Quantitative analysis to evaluate risk of habitat collapse

Criterion E	Probability of collapse
EU 28	-
EU 28+	unknown

There is no quantitative analysis available that estimates the probability of collapse of this habitat type.

Overall assessment "Balance sheet" for EU 28 and EU 28+

	A1	A2a	A2b	A3	B1	B2	B3	C/D1	C/D2	C/D3	C1	C2	C3	D1	D2	D3	E
EU28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EU28+	LC	DD	DD	DD	LC	LC	LC	LC	DD	DD	DD	DD	DD	DD	DD	DD	DD

Overall Category & Criteria			
EU 28		EU 28+	
Red List Category	Red List Criteria	Red List Category	Red List Criteria
-	-	Least Concern	-

Confidence in the assessment

Low (mainly based on uncertain or indirect information, inferred and suspected data values, and/or limited expert knowledge)

Assessors

M. Aronsson

Contributors

Habitat definition: J. Kapfer & J. Janssen

Working Group Heathland & Scrub: M. Aronsson, C. Bită-Nicolae, F. Bioret, A. Čarni, J. Capelo, P. Dimopoulos, J.A.M. Janssen & J. Loidi

Reviewers

J. Janssen

Date of assessment

17/01/2016

Date of review

29/03/2016

References

Dierssen, K. 1996. *Vegetation Nordeuropas*. Verlag Eugen Ulmer, Stuttgart.

Elvebakk, A. (1994). A survey of plant associations and alliances from Svalbard. *Journal of Vegetation Science* 5: 791-802

Elvebakk, A. in U. Bohn et al. (2003, eds). *Karte der natürlichen Vegetation Europas*. Bundesamt für Naturschutz, Bonn, pg 109-112.

Johanson, B., Tømmervik, H., Karlsen, S. R. and Elvebakk, R. 2010. *Vegetation mapping of Svalbard, Arctic Norway, utilizing Landsat TM/ETM+ data*. NORUT – NINA – UiTø.

Lindgaard, A. & Henriksen, S. 2011 (eds). *The 2011 Norwegian Red list for ecosystems and habitat types*. Norwegian Biodiversity Information Centre, Trondheim. 124 p.

Virtanen R., Lundberg P. A., Moen J. & Oksanen L. (1997). Topographic and altitudinal patterns in plant communities on European arctic islands. *Ponatis iz Bioloskega vestnika* 17: 95-113.

Virtanen R., Oksanen J., Oksanen L. & Razzhivin V.Y. (2006). Broad-scale vegetation-environment relationships in Eurasian high-latitude areas. *Journal of Vegetation Science* 17: 519-528.