

H5.1b Polar desert

Summary

The circumpolar arctic habitat polar desert is characterized by extreme low summer temperatures, low precipitation and shallow, usually base-rich, soils over permafrost and flat or low undulating relief. Within the Red List area it is confined to Svalbard. The habitat is often totally bare or has at most a very sparse low cover of rosette plants growing among bryophytes and lichens. A light snow cover can encourage somewhat more extensive growth and areas with higher precipitation where reindeer graze and defaecate benefit from more moisture and nutrients. Climate warming is also seeing a slow increase of perennial species and shrubs.

Synthesis

No data on past trends in quantity and quality are available. However, for the near future it is expected that the habitat will decrease both in area and quality as a result of climate change. The relatively small EOO combined with a serious threat results in the category Near Threatened (NT) for criterion B1. The expected changes in quality results in the same category for criterion C/D2. The category Near Threatened is the same result as was given by experts in the Norwegian Red List of Ecosystems.

Overall Category & Criteria			
EU 28		EU 28+	
Red List Category	Red List Criteria	Red List Category	Red List Criteria
-	-	Near Threatened	B1, C/D2

Sub-habitat types that may require further examination

No sub-habitats have to be considered within this type.

Habitat Type

Code and name

H5.1b Polar desert



Mountain variety of polar desert, rich in *Papaver dahlianum*, on Oxaasfjell with view over Kap Wijk, northern Isfjord, Svalbard. At the particular site *Silene acaulis* and *Salix polaris* are present, indicating succession towards other habitats as a result of climate change (Photo: Jutta Kapfer).



Papaver dahlianum near Longyearbyen, Svalbard (Photo: Petr Šmarda).

Habitat description

Polar deserts comprise stone- and gravel-dominated areas north of or at elevations above the Arctic tundra zone where the vegetation cover is fragmentary owing to low temperatures and where woody plants and

sedges are lacking. This is a circumpolar arctic habitat type that has in common with the 'true deserts' that precipitation is extreme low (< 200 mm yearly) and the vegetation growth period is very short. Around the Isfjord on Svalbard, an area very positively affected by the north atlantic current, the growing season for example is about 40-50 days. The habitat is characterized by extreme low summer temperatures (< 2 °C mean summer temperature, considered as the most important abiotic factor), shallow soils over permafrost (which is instable due to cryoturbation, causing honeycomb soil patterns), and little relief (resulting in low snow cover). Polar deserts consist of fine to medium coarse substrates resulting from frost weathering processes with particle sizes ranging from silt to gravel and stones. The sediment in most sites is calcium-rich, but acidic bedrock may occur as well. Polar deserts are restricted to continental areas influenced by cold sea currents from the Arctic Ocean.

The habitat has in general a very low vegetation cover (1-10%) or is in some areas completely free of plants. Species characteristic for Polar deserts are *Cerastium nigrescens* subsp. *arcticum*, *C. regelii*, *Draba pauciflora*, *Luzula confusa*, *Papaver dahlianum*, *Phippsia algida*, *Saxifraga hyperborea* and *S. oppositifolia*, which usually grow scattered. In between mosses and crustose lichens may be found in rock crevices; these are mainly wide-spread species. Locally, plant cover in Polar deserts may be increased owing to favourable abiotic conditions. For instance, at sites better protected from wind and frost, species like *Stereocaulon rivulorum* and *Phippsia algida* may be abundant. Increased nutrient input in areas colonized for long time by reindeer, like on the plateaus of Edgeøya, may enable an increased growth of bryophyte mats dominated by *Tomentypnum nitens*. Such areas, although in the climatic region of the polar desert, are considered Moss tundra habitat (F1.2). Some of the polar desert species (*Luzula confusa*, *Papaver dahlianum*, *Phippsia algida*) also grow in slightly warmer climates, in habitats with little competition with other species.

Polar deserts are typically found in the flat or slightly undulating lowlands and on mountain plateaus of eastern and northern Svalbard, and on glacier free parts of the Russian islands in the Barents Sea (Franz-Jozef-Land, Victoria islands and Nowaja Semlja). The mountains of these regions may have a similar plant species composition on scree habitats (type H2.1, H2.1). Moreover, Polar deserts occur all over Svalbard at elevations above 200 to 500 m a.s.l. A difference with Moss and lichen tundra (F1.2) is the general lack of typical tundra species (e.g. *Carex* spp.) including woody species (e.g. *Salix* spp., *Dryas octopetala* and *Silene acaulis*).

Indicators of good quality:

This is natural vegetation occurring in remote areas which are under limited human influence. It is generally rather stable, but may be threatened by global warming.

The following characteristics can be considered as indicators of good quality:

- Long-term stability of low vegetation cover
- Abundance of species sensitive to changes in soil moisture and temperature (like *Draba adamsii*, *Cerastium regelii*, *Saxifraga hyperborea*)
- Absence of long living and slow colonizing species indicating global warming, like *Silene acaulis*, *Dryas octopetala*, *Salix polaris* and *Festuca rubra* ssp. *richardsonii*

Characteristic species:

Flora

Vascular plants: *Alopecurus alpinus*, *Cerastium nigrescens* subsp. *arcticum*, *Cerastium regelii*, *Draba adamsii*, *Draba corymbosa*, *Draba pauciflora*, *Luzula confusa*, *Papaver dahlianum* (= *P. polare*), *Phippsia algida*, *Poa arctica*, *Ranunculus sabinii* (Russia), *Saxifraga cespitosa*, *Saxifraga hyperborea*, *Saxifraga oppositifolia*

Mosses: *Andreaea blyttii*, *Andreaea rupestris*, *Aulacomnium palustre*, *Aulacomnium turgidum*, *Bryocaulon*

divergens, *Dicranoweisia crispula*, *Dicranum elongatum*, *Drepanocladus cossonii*, *Orthothecium chryseon*, *Polytrichum spp.*, *Sanionia uncinata*, *Tomentypnum nitens*

Lichens: *Alectoria ochroleuca*, *Allantoparmelia alpicola*, *Cetraria nivalis*, *Lecanora spp.*, *Lecidea ementiens*, *Ochrolechia frigida*, *Rhizocarpon spp.*, *Stereocaulon rivulorum*, *Umbilicaria proboscidea*, *Usnea sphacelata*

Classification

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

EUNIS:

H5. Miscellaneous inland habitats with very sparse or no vegetation

(no clear relationship on EUNIS level 3)

EuroVeg Checklist (alliances):

Papaverion dahliani Hoffmann 1968 ex Daniëls et al. 2014

Saxifrago stellaris-Oxyrion digynae Gjaerevoll 1950 (partly)

Annex 1:

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Emerald:

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MAES-2:

Sparsely or unvegetated land

IUCN:

8.3 Cold desert

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

Yes

Regions

Arctic

Justification

This habitat is strictly bounded to the arctic biogeographic region of Svalbard and other islands in the arctic zone of Europe.

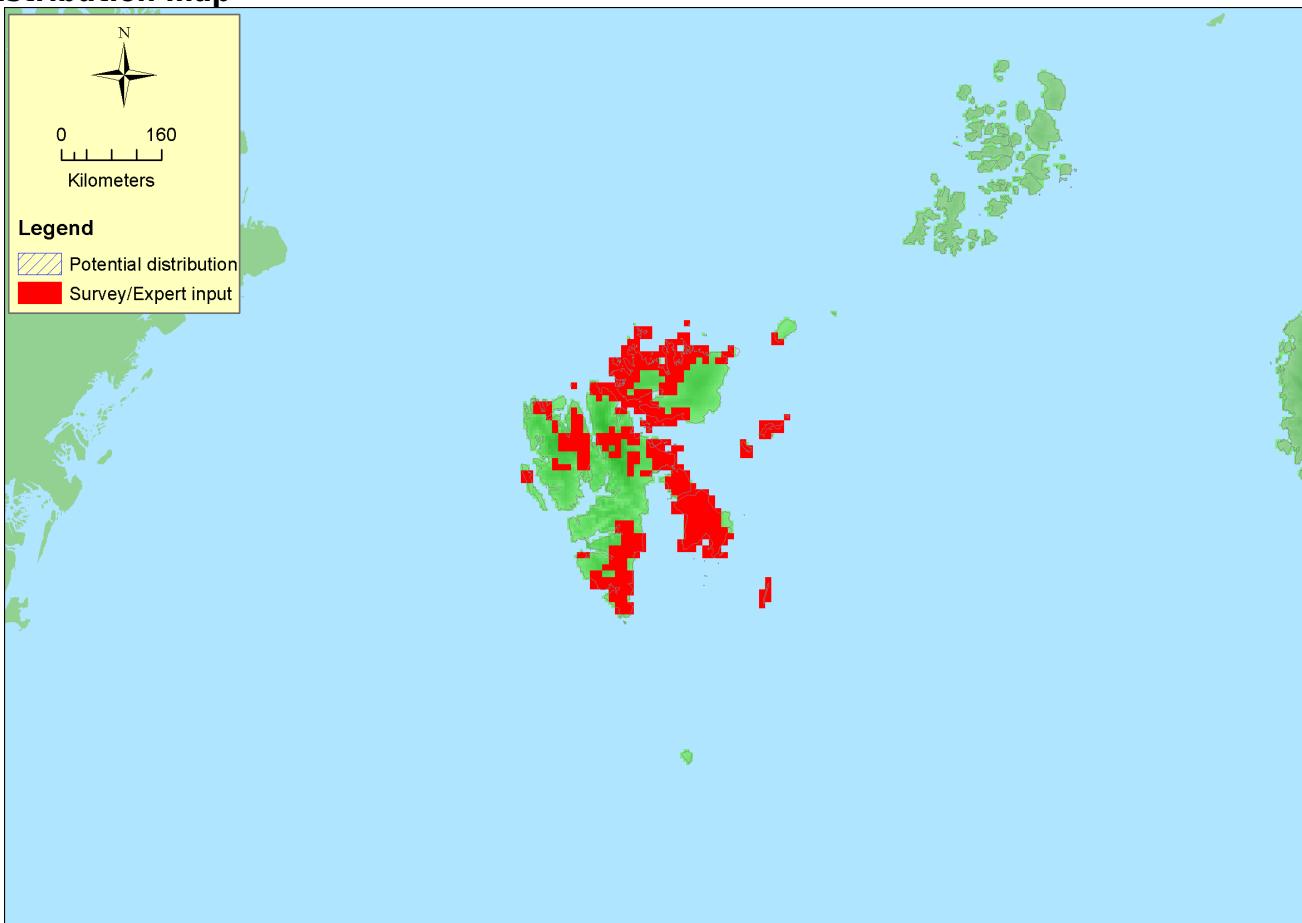
Geographic occurrence and trends

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)
Norway	Svalbard: Present	5000 (2850-7500) Km ²	Unknown	Unknown

Extent of Occurrence, Area of Occupancy and habitat area

	Extent of Occurrence (EOO)	Area of Occupancy (AOO)	Current estimated Total Area	Comment
EU 28	-- Km ²	--	-- Km ²	No occurrence in EU 28
EU 28+	163550 Km ²	419	5000 (2850-7500) Km ²	Johansen et al. 2009, Lindgaard & Henriksen 2011

Distribution map



The map is likely to be complete. Data sources: BOHN.

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

0% (No occurrence in EU 28), data known only from Norway (EU28+). Within the region covered by the Red List the habitat is restricted to Svalbard.

Trends in quantity

It is expected that climate change will cause a decrease in the area of the habitat due to succession towards (shrub) tundra, even when on the other hand deglaciation actually may cause an increase in area. Overall the negative trend is expected to dominate: in the Norwegian Red List of Ecosystems experts consider the polar deserts to have the least buffering capacity to withstand the expected climatic changes (Lindgaard & Henriksen 2011). A large part of today's polar desert may lose its climatic basis within circa 30 years if climate changes as expected.

- Average current trend in quantity (extent)

EU 28: -

EU 28+: Unknown

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

Yes

Justification

The habitat is restricted to Svalbard and faces future regression. The EOO and AOO are however larger than the thresholds for criterion B.

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

No

Justification

The habitat occurs in large patches.

Trends in quality

No occurrence in the EU28. Past changes in the quality of this habitat type cannot be evaluated as data are missing.

- Average current trend in quality

EU 28: -

EU 28+: Unknown

Pressures and threats

Polar deserts are extremely long-term survive habitats, as long as the environmental conditions are very stable. On the other hand, they are very sensitive to climate changes, pollution and mechanical disturbance like trampling, track vehicles or other human activities (coal mining around Svea, Longyearbyen and the Russian settlement of Barentsburg). Climate change is the most serious threat to the habitat. It is expected that higher temperature causes changes in abiotic and biotic conditions. Expected abiotic changes are changes in soil moisture (hyrdrology) and temperature, expected biotic changes are a low increase of stronger competitors.

List of pressures and threats

Mining, extraction of materials and energy production

Open cast mining

Pollution

Acid rain

Nitrogen-input

Climate change

Changes in abiotic conditions

Changes in biotic conditions

Conservation and management

The protected areas now cover 65 % of the Svalbard land area. All known habitats, including polar deserts, are well represented in these areas, where regulations provide robust protection against any material impact on the natural landscape. Provisions for hunting in protected areas vary. Snowmobile driving is permitted in some national parks near settlements. As most of Svalbard is now largely free of human influence, the archipelago is of great value as a reference area for research on the effects of climate change, transboundary pollution and other large-scale environmental impacts.

List of conservation and management needs

No measures

No measures needed for the conservation of the habitat/species

Measures related to spatial planning

Establish protected areas/sites

Conservation status

There is no equivalent type of the Habitat's Directive Annex 1.

When severely damaged, does the habitat retain the capacity to recover its typical character and functionality?

Only naturally. Recovery processes occur very slowly in the cold arctic climate.

Effort required

200+ years
Naturally

Red List Assessment

Criterion A: Reduction in quantity

Criterion A	A1	A2a	A2b	A3
EU 28	-- %	-- %	-- %	-- %
EU 28+	Unknown %	Unknown %	Unknown %	Unknown %

The habitat is not present in the EU28. For Svalbard no data on recent or historical trends are available. It is not likely that large changes took place over the last 50 years, but this is not 100% sure. The area of the habitat is expected to decrease in future due to succession to other habitats, and on the other hand may profit from deglaciation. No quantitative data for future trends in area are available, however. Based on lack of good data of declines, the assessment of all criteria under A are Data Deficient.

Criterion B: Restricted geographic distribution

Criterion B	B1				B2				B3
	E00	a	b	c	AOO	a	b	c	
EU 28	- Km ²	-	-	-	-	-	-	-	-
EU 28+	>50000 Km ²	No	Yes	no	>50	No	Yes	no	no

The habitat has a relatively low AOO and EOO but they do not meet the criteria for Vulnerable under B1 and B2. The EOO is however small enough to be considered as 'close to Vulnerable'. As there is a serious future threat (climate change) subcriterion (b) is met for B1, resulting in the category 'Near Threatened'.

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+	Unknown %	Unknown %	Large %	Slight %	Unknown %	Unknown %

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

Criterion C	C1		C2		C3	
	Extent affected	Relative severity	Extent affected	Relative severity	Extent affected	Relative severity
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%

The habitat is not present in the EU28. For Svalbard no information is available on present or historical changes in quality. However, the expected climate change (warming) will favour species that are more competitive, and cause a decline in – more typical – species. Such biotic and abiotic changes are likely to affect large areas of the habitat. They will proceed slowly and can be considered as a low impact in terms of severity. In quantitative terms the change is expected to be close to the Vulnerable thresholds (large extent, low severity). Possibly these thresholds will even be met, but there is no evidence for this, presently. The conclusion therefore is an assessment of Near Threatened (NT) under C/D2, and Data Deficient for other C and D criteria.

Criterion E: Quantitative analysis to evaluate risk of habitat collapse

Criterion E	Probability of collapse
EU 28	Unknown
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+	DD	DD	DD	DD	NT	LC	LC	DD	NT	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
-		-	Near Threatened	B1, C/D2

Confidence in the assessment

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

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References

Aleksandrova, V.D. 1988. *Vegetation of the Soviet polar deserts*. Cambridge University Press, Cambridge, 228 p.

Bohn, U. et al. 2003 (eds). *Karte der natürlichen Vegetation Europas*. Bundesamt für Naturschutz, Bonn, 655 p.

Daniëls, F.J.A., A. Elvebakk, N.V. Matveyeva & L. Mucina (2015). The Drabo-Corymosae papaveretea dahliani – a new vegetation class of high arctic polar deserts. *Hacquetia* DOI: 10.1515/hacq-2015-0013

Dierssen, K. 1996. *Vegetation Nordeuropas*. Verlag Eugen Ulmer, Stuttgart. 832 p.

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

Elvebakk , A. 2005. A vegetation map of Svalbard on the scale 1:3.5 mill. *Phytocoenologia* 35(4): 951-967.

Hadač, E. 1989. Notes on Plant Communities of Spitsbergen. *Folia Geobotanica et Phytotaxonomica*, Praha 24: 131-169.

Johansen, B., Tommervik, H. and Karlsen, S.R., 2009. *Vegetasjonskart over Svalbard. Dokumentasjon av metoder og vegetasjonsbeskrivelsen*. NINA Rapport 456. 57 p.

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

Thannheiser, D. 1996. Spitzbergen. *Geographische Rundschau* 48(5): 268-274.