Vegetation Descriptions

Barrens

B1 Cryptogam, herb barren

Barren areas mainly in dry landscapes of bioclimate subzones A and B. This unit is dominated by barren soils or bedrock and lacks much cover of vascular plants. Biological soil crusts cover most soils with a few scattered vascular plants, lichens, and mosses. Woody plants, sedges (Cyperaceae), and bog mosses (e.g. Sphagnum spp.) are normally absent. Horizontal plant cover is sparse (2–40% cover), and vertical structure is very low (generally < 2 cm tall), with a single layer of plants where they occur. In upland areas, vascular plant cover is generally very sparse (< 2%), often in crevices between stones or small cryoturbated polygons and hummocks (< 50 cm diameter). Snow-flush communities, composed mainly of bryophytes and biological soil crusts with cyanobacteria, often form dark streaks on the otherwise barren lands of bioclimate subzones A and B. Map unit G1 is a common inclusion in more mesic areas. B1 is also mapped in recently deglaciated areas of other subzones and was used to map small areas of mudflats and barren wetlands on coasts and deltas in more southern subzones where plant communities are not described.

Typical species. **Forbs:** *Braya glabella* ssp. *purpurascens, Cardamine bellidifolia, Cerastium arcticum, C. regelii, Deschampsia sukatschewii, Draba arctica* s.l., *D. corymbosa, D. oblongata, D. pauciflora, D. simmonsii, D. subcapitata, Minuartia rossii, Papaver, dahlianum* agg., *Potentilla hyparctica, P. pulchella, Saxifraga cernua, S. cespitosa, S. hyperborea, S. oppositifolia, S. platysepala, Stellaria longipes* s.l. **Graminoids:** *Alopecurus borealis, Deschampsia sukatschewii* ssp. *borealis, Festuca baffinensis, F. ulvicula/confusa, L. rivalis, Phippsia algida, Poa abbreviata, Puccinellia angustata.* **Mosses:** *Aulacomnium turgidum, Dicranoweisia crispula, Ditrichum flexicaule, Polytrichastrum alpinum, Polytrichum piliferum, P. strictum, Racomitrium ericoides, R. lanuginosum, Schistidium frigidum.* **Liverworts:** *Anthelia juratzkiana, Gymnomitrion corallioides, Sphenolobus minutus.* **Lichens:** *Alectoria ochroleuca, Cetrariopsis nivicum, Cetraria ericetorum, C. islandica, Cetraria delisei, Dactylina arctica, D. ramulosa, Flavocetraria cucullata, F. nivalis, Gowardia nigricans, Parmelia omphalodes, P. skultii, Sphaerophorus globosus, Stereocaulon rivulorum, Sliicta arctica, Thamnolia vermicularis* s.l.

Representative syntaxa. **Class:** *Drabo corymbosae–Papaveretea dahliani* Daniëls, Elvebakk et Matveyeva in Daniëls et al. 2016; **alliance:** *Papaverion dahliani* Hofmann ex Daniëls, Elvebakk et Matveyeva in Daniëls et al. 2016 (polar deserts of the Arctic Ocean archipelagos).

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Ellef Ringnes Island, Nunavut, Canada (Inset: *Papaver radicatum*)

B2a Cryptogam, barren complex

Mainly deglaciated Precambrian bedrock and glacial deposits abundantly covered by lichens and mosses and with inclusion of many lakes in bioclimate subzones C and B and in subzone D at higher elevations. Large areas with continuous cover of vascular plants are uncommon.

Typical species. **Lichens:** *Aspicilia* spp., *Caloplaca* spp., *Lecidea* spp., *Lecanora* spp., *Buellia* spp., *Parmelia* spp., *Porpidia* spp., *Rhizocarpon* spp., *Umbilicaria* spp., and *Xanthoria* spp. cover the rock surfaces. Slopes with fine-grained erosional material have associations of terricolous lichens (*Cladonia* spp., *Flavocetraria* spp., *Masonhalea richardsonii, Stereocaulon* spp., *Bryocaulon divergens, Alectoria ochroleuca*).

Representative syntaxa. **Class:** *Rhizocarpetea geographici* Wirth 1972 (ombrophilous lichen communities of siliceous rock surfaces, Canada). **Class:** *Racomitrietea heterostichi* Neumayr 1971 (bryophyte communities on sunny, exposed siliceous rocks, boulders and screes). Complex with graminoid and prostrate dwarf-shrub communities of bioclimate subzones B and C (see map units G1, G2, P1, P2).

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Hall Peninsula, Baffin Island, Nunavut Canada (Inset: *Rhizocarpon geographicum*)

B2b Cryptogam, barren, dwarf-shrub complex

Mainly deglaciated Precambrian bedrock and glacial deposits abundantly covered by lichens and mosses, intermixed with lakes and zonal dwarf- and low-shrub vegetation of bioclimate subzones D and E.

Typical species. **Lichens:** *Aspicilia* spp., *Caloplaca* spp., *Lecidea* spp., *Lecanora* spp., *Buellia* spp., *Parmelia* spp., *Porpidia* spp., *Rhizocarpon* spp., *Umbilicaria* spp., and *Xanthoria* spp. cover the rock surfaces, commonly separated by low-growing dwarf-shrub tundra (*Betula glandulosa, Arctous alpina, Cassiope tetragona, Rhododendron tomentosum* ssp. *decumbens, Vaccinium uliginosum* ssp. *microphyllum, V. vitis-idaea*), and the grass *Hierochloe alpina*. Slopes with fine-grained erosional material have associations of terricolous lichens (*Cladonia* spp., *Flavocetraria* spp., *Masonhalea richardsonii, Stereocaulon* spp., *Bryocaulon divergens, Alectoria ochroleuca*) and the same dwarf shrubs.

Representative syntaxa. **Class:** *Rhizocarpetea geographici* Wirth 1972 (ombrophilous lichen communities of siliceous rock surfaces, Canada). **Class:** *Racomitrietea heterostichi* Neumayr 1971 (bryophyte communities on sunny, exposed siliceous rocks, boulders, and screes). Complexes include graminoid and erect dwarf-shrub-dominated communities of bioclimate subzones D and E (see map units G4, S1, S2).

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Gaupat Lake, Baffin Island, Nunavut, Canada (Inset: *Empetrum nigrum*)

B3 Noncarbonate mountain complex

Arctic-alpine tundra complexes on mountains and plateaus with noncarbonate bedrock. Predominantly saxicolous lichen plant communities occur in dry azonal rocky habitats of stony ridges, boulder fields, talus, and screes. Plant communities of other typical alpine habitats (e.g., snowbeds, fellfields, springs, and meadows) are also common. Inclusions of mesic acidic vegetation occur on plateaus and valleys with finer-grained soils within elevation belts (A to E) that roughly correspond to climatically equivalent latitudinal bioclimate subzones based mainly on available summer warmth.

Typical species. Generally only areas with a predominance of unvegetated or lichen-covered noncarbonate bedrock are mapped as this unit.

Representative syntaxa. **Elevation belt A** (roughly corresponding to latitudinal bioclimate subzone A) **class:** *Thlaspietea rotundifolii* Br.-Bl. 1948. **Elevation belt B class:** *Carici rupestris-Kobresietea bellardii* Ohba 1974. **Elevation belt c class:** Caricetea curvulae Br.-Bl. 1948. **Elevation belt D class:** *Loiseleurio-Vaccinietea* Eggler ex Schubert 1960. **Elevation belt E class:** *Juncetea trifidi* Hadač in Klika et Hadač 1944; **alliance:** *Carici-Juncion trifidi* Nordh 1943 (windswept chionophobous habitats on acidic soils dominated by rushes).

D.S. WALKER PHOTO: M.K. RAYNOLDS

Near Nanortalik, South Greenland (Inset: *Kalmia procumbens*)

B4 Carbonate mountain complex

Arctic-alpine tundra complexes on mountains and plateaus with carbonate bedrock. The most common plant communities are those occurring in dry azonal rocky habitats of stony ridges, boulder fields, talus, and screes with predominantly saxicolous plant communities. Communities typical of other alpine habitats (e.g., snowbeds, fellfields, springs, and meadows) are also common. Larger inclusions of mesic nonacidic vegetation occur on plateaus and valleys with finer-grained soils within elevation belts (A to E) that climatically correspond to equivalent bioclimate subzones based mainly on available summer warmth.

Typical species. Generally only areas with a predominance of unvegetated or lichen-covered carbonate bedrock are mapped as this unit.

Representative syntaxa. **Elevation belt A** (roughly corresponding to latitudinal bioclimate subzone A) **class:** *Thlaspietea rotundifolii* Br.-Bl. 1948. **Elevation belt B class:** *Carici rupestris-Kobresietea bellardii* Ohba 1974. **alliances:** *Kobresio-Dryadion* Nordh. 1943 (dry zonal habitats on base-rich soils, subzones B and C); *Dryadion integrifoliae* Ohba ex Daniëls 1982 (Greenland, N America). **Elevation belt c class:** *Carici rupestris-Kobresietea bellardii* Ohba 1974; **alliance:** *Kobresio-Dryadion* Nordh. 1943; **class:** *Carici arctisibiricae–Hylocomietea alaskani* Matveyeva et Lavrinenko 2021; **alliance:** *Carici arctisibiricae–Hylocomion alaskani* Matveyeva et Lavrinenko 2023. **Elevation belt D and E class:** *Saxifrago tricuspidatae-Calamagrostietea purpurascentis* Drees et Daniëls 2009 (cryoxerophytic steppe and associated shrub on base-rich soils); **alliances:** *Saxifrago tricuspidatae-Calamagrostion purpurascentis* Cooper ex Drees et Daniëls 2009; *Puccinellion nuttallianae* Daniëls et Chytry et al. 2015.

D.A. WALKER PHOTO: D.A. WALKER

Brooks Range, Alaska (Inset: *Saxifraga oppositifolia*)

Representative syntaxa (formal vegetation units) follow the Braun-Blanquet nomenclature system (Weber et al. 2000, Westhoff and Van der Maarel 1978) and are recognized worldwide by the International Botanical Congress. Color bars to the left of each map unit description correspond to colors on the CAVM map and legend on the reverse side.

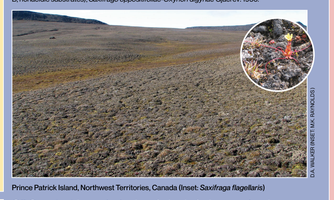
Graminoid tundras

G1 Graminoid, forb, cryptogam tundra

Tundra dominated by graminoids with large components of forbs, mosses, and lichens, mainly on mesic, often hummocky, soils in more maritime portions of bioclimate subzones A and B. Horizontal plant cover is generally 5–80%, often with a large component of soils covered by biological soils crusts; vegetation consists of a single layer generally 5–10 cm tall. In bioclimate subzone A, this unit generally occurs in more protected mesic areas with more snow and, except for the greater density of plant cover, is similar in composition to map unit B1. Sedges, woody shrubs, and bog mosses are generally absent. In bioclimate subzone B, the zonal vegetation cover is often > 75% on mesic sites and includes a mix of sedges (Cyperaceae), rushes (Juncaceae), grasses (Poaceae), forbs, prostrate dwarf shrubs (*Salix* spp. and *Dryas* spp.), lichens, and mosses. Cryptogamic crusts composed of cyanobacteria, liverworts, small mosses, and black crustose lichens are common in mesic habitats in bioclimate subzone B but not in subzone A.

Typical species. Common species in bioclimate subzone A are similar to those in map unit B1 but with greater cover, especially of vascular plants. In subzone B, the vegetation is often dominated by rushes (*Luzula* spp.) and can include large components of sedges (e.g., *Carex* spp., *Eriophorum* spp.), prostrate dwarf shrubs (*Dryas integrifolia, Salix arctica, S. rurrimularia, S. polaris*), and forbs. **Graminoids:** *Alopecurus borealis, Dupontia fisheri, Deschampsia brevifolia, D. cespitosa, D. sukatschewii* ssp. *borealis, Luzula confusa, L. rivalis, L. confusa, Phippsia algida, Poa abbreviata, P. arctica.* **Forbs:** *Cardamine bellidifolia, Cerastium regelii, Draba* spp., *Minuartia rossii, Oxyria digyna, Papaver dahlianum* agg., *Potentilla hyparctica, Ranunculus hyperboreus, Saxifraga oppositifolia, Stellaria* spp. **Mosses:** *Aulacomnium turgidum, Ditrichum flexicaule, Oncophorus wahlenbergii, Polytrichum* spp., *Racomitrium* spp., *Schistidium* spp., *Tomentypnum nitens.* **Liverwort:** *Anthelia juratzkiana.* **Lichens:** *Lecanora* spp., *Blatora* spp., *Pertusaria* spp., *Ochrolechia* spp., *Thamnolia vermicularis, Flavocetraria* spp., *Stereocaulon* spp.

Representative syntaxa. **Class:** *Drabo corymbosae-Papaveretea dahliani* Daniëls, Elvebakk et Matveyeva in Daniëls et al. 2016; **alliances:** *Papaverion dahliani* Hofmann ex Daniëls, Elvebakk et Matveyeva in Daniëls et al. 2016; *Luzulion nivalis* (Nordh. 1936) Gjaerev. 1956 (Svalbard, subzone B, nonacidic substrates). *Saxifrago oppositifoliae-Oxyrion digynae* Gjaerev. 1956.



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Prince Patrick Island, Northwest Territories, Canada (Inset: *Saxifraga flagellaris*)

G2 Graminoid, prostrate dwarf-shrub, forb, moss tundra

Moist to dry tundra in subzone C and warmer parts (local oases) of subzone B on fine-grained, often hummocky, circumneutral soils with moderate snow. Plant cover is moderate (40–100%) and 5–15 cm tall. The diversity of plant communities is much greater than in map unit G1 and includes subpixel areas of *Cassiope tetragona* snowbeds, well-developed mires, and streamside communities.

Typical species. **Sedges:** *Carex bigelowii* s.l., *C. concolor* (moister sites), *C. fuliginosa, C. rupestris, Eriophorum triste, Kobresia myosuroides.* **Rushes:** *Juncus biglumis, Luzula nivalis, L. confusa.* **Grasses:** *Alopecurus borealis, Arctagrostis latifolia, Deschampsia cespitosa, D. sukatschewii* ssp. *borealis, D. brevifolia, Dupontia fisheri, Festuca brachyphylla, Poa arctica, Puccinellia vahliana, P. wrightii.* **Forbs:** *Bistorta vivipara, Cardamine bellidifolia, Cerastium regelii, Draba nivalis, Micranthes hieracifolia, Oxyria digyna, Papaver dahlianum* agg., *Parrya nudicaulis, Pedicularis capitata, Potentilla hyparctica, Saxifraga cernua, S. hirculus, Stellaria* spp. **Prostrate dwarf shrubs:** *Dryas integrifolia, Salix arctica, S. polaris, S. reticulata.* **Mosses:** *Aulacomnium turgidum, Campylium stellatum, Hylocomium splendens, Oncophorus wahlenbergii, Polytrichum* spp., *Racomitrium lanuginosum, Tomentypnum nitens, Warnstorfia sarmentosa.* **Liverworts:** *Anastrophyllum minutum, Tetralophozia setiformis.* **Lichens:** *Cladonia rangiferina, Cladonia pyxidata, Dactylina arctica, Flavocetraria cucullata, F. nivalis, Masonhalea richardsonii, Sphaerophorus globosus, Thamnolia* spp.

Representative syntaxa. **Class:** *Carici arctisibiricae–Hylocomietea alaskani* Matveyeva et Lavrinenko 2023. **alliance:** *Salici polaris–Hylocomion alaskani* Matveyeva et Lavrinenko 2021 (Russia, Svalbard). **Class:** *Carici rupestris-Kobresietea bellardii* Ohba 1974; **alliances:** *Kobresio-Dryadion* Nordh. 1943; *Dryadion integrifoliae* Ohba ex Daniëls 1982 (Greenland, N America). **Class:** *Saxifrago tricuspidatae–Calamagrostietea purpurascentis* Drees et Daniëls 2009; **alliance:** *Saxifrago tricuspidatae-Calamagrostion purpurascentis* Cooper ex Drees et Daniëls 2009 (cryoxerophytic steppes in Greenland, N America).

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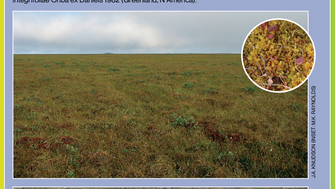
Above: Green Cabin, Banks Island, Northwest Territories, Canada (Inset: *Carex rupestris*)
Below: Near Eureka, Ellesmere Island, Nunavut, Canada (Inset: *Salix arctica*)

G3 Nontussock sedge, dwarf-shrub, moss tundra

Areas with tundra vegetation on peaty nonacidic soils in bioclimate subzone D, where it is the zonal vegetation, and also on moist nonacidic soils in bioclimate subzones C and E. Frost boils (barren patches of cryoturbated soil) are common on silty soils ("spotted tundra" in the Russian literature). Plant cover varies from 50–100%. Plant heights are generally 10–20 cm. Hemiprostrate and erect dwarf shrubs are common, but generally do not form a closed canopy and may grow up to 40 cm high at the southern extent. Well-developed moss layers (5–20 cm thick) are common. Low-shrub (40–200 cm tall) and some tall-shrub (> 2 m) willow thickets occur as subpixel inclusions along stream margins.

Typical species. **Sedges:** *Carex bigelowii, C. concolor, C. fuliginosa, C. membranacea, C. scirpoidea, Eriophorum triste.* **Rushes:** *Juncus biglumis, Luzula arcuata, L. confusa.* **Grasses:** *Arctagrostis latifolia, Deschampsia sukatschewii* ssp. *borealis, Poa arctica.* **Erect dwarf shrubs:** *Rhododendron lapponicum, Salix glauca, S. hastata, S. krylovii, S. pulchra, S. reptans, S. richardsonii.* **Prostrate and hemiprostrate dwarf shrubs:** *Arctous rubra, Betula nana, Cassiope tetragona, Dryas integrifolia, D. punctata, Salix arctica, S. polaris, S. reticulata.* **Forbs:** *Astragalus umbellatus, Bistorta vivipara, Equisetum scirpoides, Eutrema edwardsii, Huttenilella integrifolia, Lagotis glauca, Pedicularis capitata, P. langii, Pyrola grandiflora, Sagina nivalis, Saxifraga oppositifolia, S. hirculus, Stellaria longipes* s.l., *Tephroseris frigida, Tofieldia coccinea, T. pusilla, Valeriana capitata.* **Mosses:** *Aulacomnium turgidum, Dicranum* spp., *Ditrichum flexicaule, Distichium capillaceum, Hylocomium splendens, Racomitrium lanuginosum, Rhytidium rugosum, Tomentypnum nitens.* **Liverworts:** *Ptilidium ciliare.* **Lichens:** *Bilimbia lobulata, Cladonia pocillum, Dactylina arctica, Flavocetraria cucullata, F. nivalis, Lobaria linita, Nephroma expallidum, Peltigera aphthosa, P. scabrosa, Psoroma hypnorum, Thamnolia vermicularis.*

Representative syntaxa. **Class:** *Carici arctisibiricae–Hylocomietea alaskani* Matveyeva et Lavrinenko 2023. **alliances:** *Salici pulchrae–Caricion lugentis* Sinelnikova 2021 (E Siberia, Chukotka); *Carici arctisibiricae–Hylocomion alaskani* Matveyeva et Lavrinenko 2023 (W Arctic Russia and Siberia). **Class:** *Carici rupestris-Kobresietea bellardii* Ohba 1974; **alliance:** *Dryadion integrifoliae* Ohba ex Daniëls 1982 (Greenland, N America).



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Above: Franklin Bluffs, North Slope, Alaska, USA (Inset: *Tomentypnum nitens*)
Below: Near mouth of the Kolyma River, Ambarchik, Sakha Republic, Russia (Inset: *Carex bigelowii* ssp. *arctisibirica*)

G4 Tussock-sedge, dwarf-shrub, moss tundra

Tussock tundra vegetation, mainly in bioclimate subzone E, on silty, unglaciated, acidic, ice-rich permafrost soils, especially in Beringia (NE Russia, W and N Arctic Alaska, and NW mainland Canada). Horizontal plant cover is nearly continuous (80–100% cover). Vertical plant structure includes 2–3 layers and is 20–40 cm tall. A less robust form of tussock tundra grows in subzone D on acidic sands, with smaller tussock sedges and less abundant and shorter dwarf shrubs that do not develop the tussocks. In warmer areas the erect dwarf shrubs are dominant.

Typical species. **Tussock sedge:** *Eriophorum vaginatum, Carex bigelowii* s.l. **Other graminoids:** *Eriophorum angustifolium, Poa arctica.* **Prostrate and erect dwarf shrubs:** *Arctous alpina, A. rubra, Betula nana, Chamaepericlymenum suecicum, Empetrum nigrum, Rhododendron tomentosum* ssp. *decumbens, Rubus arcticus, R. chamaemorus, Salix pulchra, Vaccinium uliginosum, V. vitis-idaea.* **Forbs:** *Aconongonon triptereocarpum, Bistorta plumosa, Micranthes nelsoniana, Pedicularis lapponica, P. labradorica, Taphrocseris frigida.* **Mosses:** *Aulacomnium palustre, A. turgidum, Dicranum elongatum, D. laevidens, Hylocomium splendens, Polytrichum strictum, Sphagnum balticum, S. russowii.* **Liverworts:** *Tritomaria quinquedentata.* **Lichens:** *Alectoria nigricans, Bryocaulon divergens, Cladonia amaurocraea, C. arbuscula, C. mitis, C. rangiferina, Flavocetraria cucullata, F. nivalis, Ochrolechia frigida, Peltigera aphthosa, P. canina.*

Representative syntaxa. **Class:** *Carici arctisibiricae–Hylocomietea alaskani* Matveyeva et Lavrinenko 2023. **alliance:** *Cassiopo tetragonae–Eriophorion vaginati* Matveyeva et Lavrinenko 2023 (Russia, Alaska). **Class:** *Oxycocco-Sphagnetea* Br.-Bl. et Tx. ex Westhoff et al. 1946; **alliance:** *Sphagnion medi* Kästner et Flössner 1933.

D.A. WALKER PHOTO: M.K. RAYNOLDS

Sagwon, Brooks Range foothills, North Slope, Alaska, USA (Inset: *Eriophorum vaginatum*)

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Prostrate-shrub tundras

P1 Prostrate dwarf-shrub, herb, lichen tundra

Dry and mesic tundra dominated by prostrate dwarf shrubs, mainly on nonacidic soils in continental and drier parts of bioclimate subzones B and C and corresponding elevational belts (which can include acidic substrates). Plant cover is dominated by prostrate dwarf shrubs (< 10 cm tall) with many forbs and lichens. The vegetation is open or patchy (20–80% cover), with plants 5–10 cm tall. Vascular plants cover about 5–25%, lichens and mosses cover 30–60%. In subzone C this vegetation is richer in vascular species, particularly sedges, grasses, and forbs.

Typical species. **Prostrate dwarf shrubs:** *Dryas integrifolia, D. punctata, D. octopetala* s.l., *Salix arctica, S. polaris, S. rotundifolia, S. nummularia.* **Graminoids:** *Alopecurus borealis, Carex misandra, C. rupestris, Deschampsia brevifolia, D. cespitosa, D. sukatschewii* ssp. *borealis, Eriophorum triste, Juncus biglumis, Luzula confusa, L. rivalis.* **Forbs:** *Androsace chamaejasme, Bistorta vivipara, Geum glaciale, Lloydia serotina, Oxytropis arctica, Pedicularis oederi, Saxifraga hirculus, S. cespitosa, S. oppositifolia, Silene acaulis.* **Mosses:** *Aulacomnium turgidum, Distichium capillaceum, Ditrichum flexicaule, Encalypta* spp., *Hylocomium splendens, Hypnum bambergeri, Pohlia* spp., *Polytrichum* spp., *Sanionia uncinata, Tomentypnum nitens.* **Lichens:** *Cladonia pocillum, Flavocetraria nivalis, Lecanora epibryon, Ochrolechia frigida, Pertusaria* spp., *Thamnolia vermicularis.*

Representative syntaxa. **Class:** *Carici arctisibiricae–Hylocomietea alaskani* Matveyeva et Lavrinenko 2021; **alliance:** *Salici polaris–Hylocomion alaskani* Matveyeva et Lavrinenko 2021. **Class:** *Carici rupestris-Kobresietea bellardii* Ohba 1974; **alliances:** *Kobresio-Dryadion* Nordh. 1943 (Atlantic and Arctic Ocean Islands); *Dryadion integrifoliae* Ohba ex Daniëls 1982 (Greenland, N America).

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Above: Green Cabin, Banks Island, Northwest Territories, Canada (Inset: *Dryas integrifolia*)
Below: Near Popov Polar Station, Ostrov Belyy, Yamalo-Nenets Autonomous Okrug, Russia (Inset: *Salix nummularia*)

P2 Prostrate /hemiprostrate dwarf-shrub, lichen tundra

Hemiprostrate, ericaceous, dwarf-shrub communities in sites with somewhat deeper than average winter snow cover. Zonal vegetation in maritime and acidic portions of bioclimate subzone C, where these communities occupy a large portion of the landscape. This unit is common on siliceous bedrock of Svalbard, Greenland, Baffin Island, and Ellesmere Island. Plants cover 40–100% of the surface. The height of the plant canopy is 10–20 cm.

Typical species. **Hemiprostrate dwarf shrubs:** *Cassiope tetragona, Empetrum nigrum.* **Prostrate dwarf shrubs:** *Dryas integrifolia, Rhododendron tomentosum* ssp. *decumbens, Salix arctica, S. herbacea, S. nummularia, S. polaris.* **Graminoids:** *Luzula confusa, L. rivalis.* **Mosses:** *Aulacomnium turgidum, Hylocomium splendens, Polytrichum juniperinum, Sanionia uncinata, Tomentypnum nitens.* **Forbs:** *Bistorta vivipara, Oxyria digyna, Silene acaulis.* **Lichens:** *Cetrariella delisei, Peltigera aphthosa, Solorina crocea, Stereocaulon* spp., *Thamnolia vermicularis.*

Representative syntaxa. **Class:** *Loiseleurio procumbentis-Vaccinietea* Eggler ex Schubert 1960. **alliances:** *Loiseleurio-Arctostaphylion* Kalliola ex Nordh. 1943 (windswept acidic habitats, N Europe); *Hierochloo alpinae-Dryadion octopetalae* Peinado et al. 2019 (N America counterpart to *Loiseleurio-Arctostaphylion*). **Class:** *Carici rupestris–Kobresietea bellardii* Ohba 1974; **alliances:** *Oxytropidion nigrescentis* Ohba 1974 (Taymyr, Yakutia); *Androsacio arctisibiricae–Aconogonion lawnanni* Kucherov et Daniëls 2005 (tundra steppe and ridges, NE Asia). **Class:** *Salicetea herbaceae* Br.-Bl. 1948; **alliance:** *Cassiopo-Salicion herbaceae* Nordh. 1943 (mesic acidic tundra with moderate snow in maritime regions).

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Near Zackenberg, East Greenland (Inset: *Cassiope tetragona*)

Erect-shrub tundras

S1 Erect dwarf-shrub, moss tundra

Communities dominated by hemiprostrate and erect dwarf shrubs less than 40 cm tall. This is the zonal vegetation in maritime areas of bioclimate subzone D on moist to dry acidic soils in Greenland and the Canadian Shield. Drier lichen-rich, dwarf-shrub tundras are common in the Russian Arctic and occur in vegetation complexes with lichen-covered bedrock on the Canadian mainland and Baffin Island. Sedge-fussock understory is common in Beringia. Plant cover is continuous (80–100% in moist areas) to sparse (5–50% on dry ridges).

Typical species. **Dwarf shrubs:** *Arctous alpina, A. rubra, Betula nana, B. glandulosa, Cassiope tetragona, Diapensia lapponica, Empetrum nigrum, Kalmia procumbens, Rhododendron tomentosum* ssp. *decumbens, Salix glauca, S. nummularia, Vaccinium myrtillus, V. uliginosum* ssp. *microphyllum, V. vitis-idaea.* **Graminoids:** *Avenella flexuosa,* Carex *bigelowii* s.l., *Eriophorum vaginatum, Festuca brevissima.* **Mosses:** *Aulacomnium turgidum, Dicranum* spp., *Hylocomium splendens, Polytrichum hyperboreum, P. piliferum, Racomitrium lanuginosum.* **Liverworts:** *Gymnomitrion corallioides.* **Lichens:** *Alectoria ochroleuca, A. nigricans, Bryocaulon divergens, Cetraria nigricans, Cladonia arbuscula, C. rangiferina, Flavocetraria cucullata, F. nivalis, Masonhalea richardsonii, Sphaerophorus globosus, Stereocaulon alpinum.*

Representative syntaxa. **Class:** *Carici arctisibiricae–Hylocomietea alaskani* Matveyeva et Lavrinenko 2023; **alliance:** *Salici pulchrae–Caricion lugentis* Sinelnikova 2021 (E Siberia, Chukotka); *Dryado octopetalae–Caricion arctisibiricae* Koroleva et Kulyugina in Chytry et al. 2016 (Russian Arctic). **Class:** *Loiseleurio-Vaccinietea* Eggler ex Schubert 1960; **alliances:** *Phyllodoco-Vaccinion myrtilli* Nordh. 1943 (Fennoscandia, Iceland, NW Russia, Greenland); *Loiseleurio-Arctostaphylion* Kalliola ex Nordh. 1943 (wind-exposed habitats of Scandinavia, N Russia, Svalbard, Iceland, and Greenland). **Class:** *Betulo carpaticae-Alnetea viridis* Rejmánek ex Boeuf, Theurillat, Willner, Mucina et Simler in Boeuf et al. 2014; **alliance:** *Arcto erythrocarpae–Salicion* Sekretareva 2003 (Chukotka, Alaska).

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Above: Near Laborovaya, northern Polar Urals foothills, Yamalo-Nenets Autonomous okrug, Russia (Inset: *Betula nana*)
Below: Daring Lake, Northwest Territories, Canada (Inset: *Arctous alpina*)

S2 Low-shrub, moss tundra

Communities dominated by low shrubs greater than 40 cm tall, often with well-developed peatlands on moist surfaces and including well-drained uplands. Zonal vegetation in warmer and maritime parts of bioclimate subzone E, and common in areas with deep active layers, such as riparian corridors. This unit includes some areas with scattered *Pinus pumila* stands east of the Anadyr River in Chukotka.

Typical species. **Low shrubs:** *Alnus viridis, Betula glandulosa, B. divaricata, Salix* spp., *Spiraea stevenii.* **Dwarf shrubs:** *Betula nana, Empetrum nigrum, Rhododendron tomentosum* ssp. *decumbens, Vaccinium uliginosum, V. vitis-idaea.* **Mosses:** *Aulacomnium turgidum, Hylocomium splendens, Sanionia uncinata, Sphagnum* spp. Low and tall willows and alders are abundant along drainages and near treeline. Rich assemblages of forbs occur in shrublands along streams. A few trees reach into this subzone along the southern river valleys (e.g., *Betula pubescens* ssp. *tortuosa, B. platyphylla, Larix laricina, L. cajanderi, Picea abies* ssp. *obovata, P. glauca, P. mariana, Populus balsamifera, P. suaveolens, Salix arbusculoides).*

Representative syntaxa. **Class:** *Loiseleurio procumbentis–Vaccinietea* Eggler ex Schubert 1960. **alliance:** *Polytrichastro alpini–Alnion fruticosae* all. prov. Sekretareva 1999 (foothills, Chukotka). **Class:** *Betulo carpaticae–Alnetea viridis* Rejmánek ex Boeuf, Theurillat, Willner, Mucina et Simler in Boeuf et al. 2014; **alliances:** *Alnion viridis* Schnyder 1930 (moist to dry *Alnus viridis* communities and alder savannas). *Salicion callicarpaea* Daniëls in Mucina et al. 2016 (herb-rich willow scrub, Greenland). *Salicion phylicifoliae* Dierssen 1992 (willow scrub of montane stream banks in N Europe and Greenland). *Geranio albiflorum–Salicion* Sekretareva 2011 (Polar Urals); *Empetro sibiricae–Pinion pumilae* Neshatayeva 1990 (Chukotka); *Polemonio acutiflorum–Salicion glaucae* Lavrinenko et Lavrinenko 2021 (willow scrub, Siberia); *Ribo tristis–Alnion fruticosae* all. prov. Sekretareva 1999 (Chukotka); *Carici scirpoidae–Alnion fruticosae* Sekretareva 1999 all. prov.

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Above: Happy Valley, Brooks Range foothills, North Slope, Alaska, USA (Inset: *Salix pulchra*).
Below: Vaskiny Dachi, Central Yamal Peninsula, Yamalo-Nenets Autonomous okrug, Russia (Inset: *Salix lanata*)

Wetlands

W1 Sedge/grass, moss wetland complex

Wetland complexes of bioclimate subzones B and C dominated by sedges, grasses, and mosses. The complexes occur as a mix of wetland vegetation in low wet areas with many ponds and moist elevated microsites (e.g. map unit G2) associated with patterned ground.

Typical species. **Graminoids:** *Alopecurus borealis, Arctagrostis latifolia, Calamagrostis holmii, Carex concolor, C. rariflora, Eriophorum russeolum, E. scheuchzeri, E. triste, Pleuropogon sabinei.* **Forbs:** *Bistorta vivipara, Cardamine polemonioides, Cerastium regelii, Caltha palustris* ssp. *radicans, Saxifraga cernua, Micranthes foliolosa, Pedicularis albolabiata, P. arctoeuropaea.* **Mosses:** *Bryum pseudotriquetrum, Calliergon giganteum, Campylium stellatum, Cinclidium arcticum, C. subrotundum, Hamatocaulis vernicosus, Limprichtia revolvens, Meesia triquetra, Plagiomnium ellipticum, Warnstorfia sarmentosa.* Grasses *(Alopecurus borealis, Dupontia fisheri, Pleuropogon sabine)* are more important in bioclimate subzone B wetlands than in subzone C. Elevated microsites have moist vegetation, prostrate dwarf-shrub, forb, moss tundra species such as *Carex atrofusca, C. fuliginosa, C. membranacea, Eriophorum triste, Kobresia simpliciuscula, Salix arctica, S. reticulata,* and *Tomentypnum nitens.* **Lichens:** *Cladonia pocillum, Flavocetraria nivalis, Lecanora epibryon, Ochrolechia frigida, Pertusaria* spp., *Thamnolia vermicularis.*

Representative syntaxa. **Class:** *Scheuchzerio-Caricetea* (Nordh. 1936) Tx. 1937 nom. ambigum. **alliances:** *Caricion stantis* Matveyeva 1994 (Taymyr Peninsula, Vaigach Island); *Scheuchzerion palustris* Nordh. ex Tx. 1937.

D.A. WALKER PHOTO: P. KUNEPATOVA

Near Resolute, Cornwallis Island, Nunavut, Canada (