

Arctic plant life

Modest and tough beauties on the ground



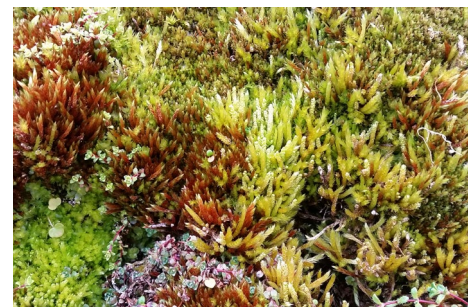
Arctic summers are short, cold and unpredictable, but plants live even in the most barren places and the region is greener than you might expect. Plant richness is lower in the Arctic than further south, but you will find an impressive diversity of species, fascinating adaptations and ecosystem variations, many of which are easy to observe when walking on the tundra. Plants do not exist to be beautiful or fascinating; however, they play a critical role in carbon cycling and energy balance of Arctic ecosystems. Some species are common and circumpolar, whilst specialists and rare species are found in small, defined areas.



Vegetative reproduction by bulbils provide an efficient way of spread and recruitment in plants that rarely develop seeds to maturity, e.g. drooping saxifrage.



Boreal Jacobs-ladder is one of the few blue-colored Arctic plants. Stripes in the flower guide insects to food (nectar and pollen), and pollination is the reward for the plants.



Moss species are numerous and basic in most Arctic ecosystems.

Arctic plants are more than colorful flowers

Arctic plant life, or flora, includes vascular plants like bushes, herbs, grass and sedges, but also mosses, lichens and fungi. Trees can be found in a few places in the Low Arctic, including Russia and North America. Some plants have colorful flowers, while others appear like a green or dusty cover on the ground. A major part of plant biomass is below ground, like roots, bacteria, and fungi hyphae. More than 2200 species of vascular plants live in the Arctic. Diversity varies among regions, e.g. Svalbard has 170 vascular plant species whereas about 700 species live around the Bering Strait.

Arctic plants are adapted to cold climate and short growing seasons. Most Arctic plants only grow a few cm tall. Trees and bushes can only survive in the southernmost parts. Despite slow growth rates, some single plants grow huge and very old. Genetic studies reveal ages of some sedge plant mats more than 3000 years old.



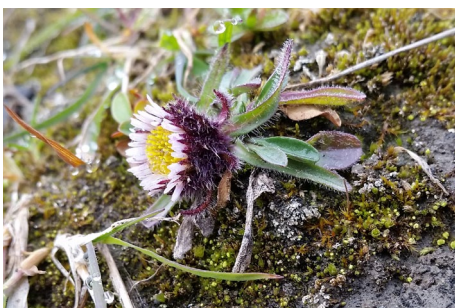
The parabolic flower of mountain avens maximizes incoming radiation to the flower centre, raising internal temperature and chances of its seed ripening.



In Arctic meadow grasses, new plants develop while still attached to the parent plant. This happens in addition to the production and dispersal of seed, as a shortcut in cold growing seasons when seeds are not fully ripe.



The woolly hairs of a cotton grass have seeds at the base, an adaptation to wind dispersal. Cotton grass is a typical wetland species and makes landscapes look as if they are covered by snow.



The hairs of snow fleabane protect the plant against dehydration, and the dark color increases temperature needed for the seeds to ripen.



Snow buttercups grow in wet snow beds and insects are attracted to the yellow flower.



Grasses and sedges can form large clones as they send runners in all directions. They are still just one individual and can reach a very advanced age.



Vegetation responds to small changes in environmental conditions, like in patterned ground formed by the sorting of sediments in freeze-thaw cycles.

Adaptations

Plants have developed impressive and fascinating adaptations to survive in the Arctic. Growing close to the ground and close to a neighbor protects plants against low temperatures and mechanical damage from ice, snow and dust. Hairy leaves and stalks are striking in many species. These features protect plants from mechanical damage, and capture moisture and sunlight. Arctic plants can photosynthesize at extremely low temperatures, some even under a snow cover. Several Arctic plants prefabricate flower buds years in advance allowing them to bloom rapidly when snow melts.

Most vascular plants are wind pollinated, including grasses, sedges and many herbs. Self-fertilization is frequent as many species are hermaphrodites. Many Arctic plants produce impressive colored flowers despite limited nutrient resources, extreme climate and few pollinators. Flies are not efficient pollinators but important in many common white and yellow flowers. Yellow flowers reflect ultraviolet light, making them look purple to insects. Blue and purple flowers are more common in Arctic regions with more pollinators and specialist pollinators. In Svalbard specialized

pollinators like bumblebees or butterflies are missing, and species with blue and purple flowers are few. A dark flower has the advantage of capturing sunlight, increasing temperature in the center of the flower and promoting the ripening of seeds.



Cushions of moss campion act as a tundra compass. Flowers start to develop on the south-facing warmer side and continue on the north-facing side only during long and warm summers.

Mosses, lichens and mushrooms – important and underrated Arctic plants

About 900 moss species cover enormous areas in Arctic wetlands and valleys. In moss tundra, these species make up 98 % of the living biomass. Mosses do not have seeds but reproduce by spores or asexually by shoot fragments. Some mosses can stay alive in a dry state for years and restart growth when conditions get favorable.

Formally, fungi and lichens are not plants, but they still deserve attention. A lichen is an organism with a green alga living among tiny fungi filaments in a mutualistic relationship. An amazing 1800 species of lichens live

in the Arctic; this is an incredible 10% of lichen species' diversity worldwide. Crustaceous lichens grow on boulders and cliffs, while other species grow on soil in heaths or exposed gravel ridges.

More than 2000 species of fungi occur in the Arctic, most of them microorganisms hardly visible to the naked eye. Some fungi are mushrooms. Delicious and edible species are found throughout the Arctic, including Svalbard. Poisonous species occur and, as always, the rule is not to eat mushrooms unless you are 100% sure they are edible.



Mosses produce spores instead of seeds. These develop in sporophytes on top of the green moss plants like alpine haircap moss.



Young puffball mushrooms are edible and delicious. Poisonous fungi occur in the Arctic so never eat them unless you are 100% sure that they are edible.



Crustaceous lichen looks like colorful paintings on boulders and cliffs, each color representing individual species.

Signs of disturbance

- When there are no signs of trampling or disturbance, scattered walking is a good strategy to prevent paths in robust vegetated areas with low number of visitors.
- When the number of visitors is high and a track is available, walking should be organized to prevent parallel tracks.
- If signs of disturbance are clear, and there are no obvious main tracks, consider leaving the area and finding an alternative site.



Fragile and loose vegetation cover and soil is easily eroded. A site-specific guideline developed for a particular site describes how and where to move to prevent further degradation.

Arctic vegetation

Plants with similar ecological requirements grow together and make up the vegetation. Vegetation can be a continuous plant cover or only scattered plants. Diversity of Arctic vegetation ranges from barren land with only lichens on boulders, to lush and vigorous spots with high biomass and numerous species.

Arctic vegetation types occur in mosaic and can change completely within only a few centimeters. Vegetation shifts along ecological gradients like moisture (dry to wet), topography (exposed ridges to protected snow beds), nutrient availability (low to high) and soil texture (fine to coarse-grained). Wherever you are in the Arctic, vegetation is distributed and identified along such gradients.

Heath vegetation is dry or moist and dwarf shrubs, ericaceous species and lichens are common. Mosses, grasses and sedges dominate wetlands. Nitrogen is an essential nutrient and a main limiting factor to plant

production in the Arctic, due to low temperatures and slow decomposition. On and underneath Arctic bird cliffs, guano from birds adds plenty of nutrients, and bird cliff vegetation is highly productive and spectacular in their shocking green appearance. Similar green colors occur by cultural remains like slaughtering places or hunting cabins, indicating increased level of nutrients over the course of centuries.

Arctic plant life change

A changing Arctic climate affects plant species and vegetation. Warmer and wetter summers, and longer growing season allows some common native plants to grow taller and expand, while some rare high-arctic species struggle under the new conditions. Non-native species have higher chances of survival and expansion in warmer climate and have the potential to change native plant life. Preventing the introduction of non-natives into the Arctic is ever more important in a changing climate.



Warmer climates make conditions more favourable for non-native species, as they can manage to survive and set seeds. In this manner, red clover has been introduced in most Arctic regions, including Svalbard settlements.



Millions of seabirds bring nutrients, guano, to arctic coasts, turning bird cliffs into high-productive green spots in the landscape.



To observe the details in an Arctic plant you should use a lens and get down on your knees.

Tips for experiencing plant life

- We invite all visitors to bend down on their knees to observe the fascinating Arctic plants.
- Bring a magnifying glass or hand-lens for observation of details in flowers and leaves.
- Bring a flora guidebook to identify plants that you explore.
- Take a close-up picture as a memory.


Regulations

According to the Svalbard Environmental Protection Act, all plants and vegetation are protected. Flora must not be damaged by picking, trampling or other kinds of disturbance. The regulation does not exclude visitors from walking on the tundra but calls upon attentiveness and awareness to prevent any disturbance and damage to plants. In a few nature reserves, landing is prohibited to protect the flora from any trampling. Introduction of plants to Svalbard is prohibited.

In other Arctic regions, national and local regulations might include other or different provisions. Always check and abide by legal requirements in the area you visit.

Guidelines

- Visitors should clean all gear, including shoes, clothes and backpacks before leaving their home country, to prevent introducing alien species to the Arctic.
- Do not pick flowers. In some parts of the Arctic, flora is protected by law; in others not. AECO regards all flora as protected and asks you not to pick flowers, seeds or any part of plants.
- Try to walk outside of wet, vegetated area as they are particularly vulnerable to trampling.
- Avoid brinks and steep vegetated slopes when walking on the tundra. Exposed ridges and slopes have fragile and loose vegetation cover and soils erode easily. Natural recovery is very slow and any damage from trampling will be visible for decades.
- Stay on established paths when such are present, to avoid parallel trampling and new tracks.
- Walk in vegetation-free areas when possible, to minimize trampling on vegetation.



Arctic wetlands are productive ecosystems dominated by mosses. Walk gently or pass around to prevent damage.

Text and photos: Dagmar Hagen, Norwegian Institute for Nature Research and Tommy Prestø, NTNU University Museum.