



Landscapes & Vegetation Zones

The Arctic boasts a diverse array of landscapes, ranging from pack and drift ice to rugged shorelines, flat coastal plains, rolling hills, tundra, and mountains. The region also contains abundant lakes and several of the world's mightiest rivers. The largest mountain ranges in the Arctic include those in northeastern Asia, the Byrranga Mountains on the Taimyr Peninsula, and the northern tip of the Urals. Mount Gunnbjorn in eastern Greenland, at 3,700 meters above sea level, ranks as the highest mountain.

The Arctic Ocean is littered with islands, which are mostly fragments of the Asian, European, and North American continental masses. Arctic islands are predominantly mountainous, and while some are inhabited, others are completely blanketed in snow and ice and therefore uninhabitable.

The type of terrain and the amount of sunlight largely govern opportunities for plants. Moving northward, the amount of heat obtainable to support plant life drops significantly. In the northernmost areas, plants are at their metabolic limits, and minute differences in summer warmth correspond to considerable differences in the energy available for plant maintenance, growth, and reproduction. This constricts not only the variety of plants, but their sizes, abundances, and growth rates.

From North to South there are Four Main Categories of Land Cover

- **Polar desert** consists mainly of bare soils and rocks. The sparse plant life is composed primarily of mosses, sedges, lichens, small tundra shrubs and, rarely, flowering plants occurring in sheltered areas. Polar desert characterizes the mountainous areas of islands and inland mountain ranges. The northern and alpine upper boundary (snow line) of this zone borders the zone of permanent snow and ice.
- The **tundra** encompasses vast expanses of open plains with continuous low vegetation, such as mosses, lichens, low-growing grasses, dwarf willows and other shrubs. Unlike polar deserts, tundra has a thick cover of loose sediment that supports plant life. Numerous lakes, ponds, and swamps dot the landscape, and weathering from alternating periods of freezing and thawing continuously reshapes the surface. Underlying the tundra are various degrees of permafrost—permanently frozen ground that remains at or below 0° C.
- A **forest-tundra transitional zone** lies between the true tundra and the northern boreal forest zones. Here, tundra occurs on more or less flat areas or high in the mountains, while forests skirt the lower mountain slopes and cover foothills and river banks. Trees here may reach ten meters or taller.

- The **taiga, or northern boreal forest**, consists of tree-covered terrain interspersed with tundra-like open areas. Moving southward toward the sub-Arctic/temperate southern boreal forest, the forest becomes more dense and the trees larger. This vast belt of greenery represents the world's biggest expanse of coniferous forest. It spans most of inland Canada, Russian Siberia, Alaska, Sweden, Finland, and Norway.

Rivers and Lakes

Low evaporation rates in the Arctic have given rise to a dense network of rivers. Most are short (only 20–100 kilometers). However, the Yenisei, Lena, Indigirka, and Mackenzie rivers, with only their lower reaches located in the Arctic, exceed lengths of 1,000 kilometers. Collectively, regional rivers pour more than 4200 cubic kilometers of freshwater into the Arctic Ocean annually, along with about 221 million tons of sediment. These volumes are increasing as glacier melting and permafrost thawing accelerates.

Arctic river volumes vary greatly throughout the year. In spring, rivers carry ice downstream from their upper reaches, resulting in ice congestion and destructive floods that can quickly wash away riverbanks. Summer rains bring short floods as well, because the frozen soil prevents the absorption of meltwater. Ice formation begins in late August in the north and in early October in the south. Northern rivers and lakes remain frozen for eight to ten months a year, with shallow streams often freezing all the way to the bottom. Ice starts to break up in late spring.

The lowlands have an abundance of mostly shallow and small lakes. Small river valleys often become indistinguishable from local marshes and lakes, with the watercourse splitting into a multitude of overlapping and diverging channels. Most lowland lakes are created by meltwater from thawing permafrost. These thermokarst lakes contain copious amounts of organic matter from the boggy areas that drain into them. Relatively few lakes occur in the mountainous regions, but they are known for their scenic beauty and pure water. Among the largest are the Bolshoye Nevolnichye, Bolshoye Medvezhye, and Taymyr lakes.

Ice

In many ways, ice defines the Arctic. Together, the Greenland and other regional ice sheets, innumerable glaciers, and Arctic Ocean sea ice are estimated to contain about 10 percent of the world's freshwater supply. This enormous reservoir of frozen water plays a profoundly important role in moderating global climate, as it reflects sunlight and keeps polar regions cool.

Glaciers and icefields, which form on land by the compaction and re-crystallization of snow, slip very slowly downhill or spread outward due to their own weight. There is no definitive count of Arctic glaciers. However, the region as a whole accounts for nearly half of the world area of mountain glaciers and ice caps. In Canada alone, land-based ice covers an estimated 200,000 square kilometers—the majority in high northern latitudes—and 54,000 square kilometers of the

Russian Arctic is locked in ice. Since the early 1990s the overall pace of glacial and ice-sheet melting has sped up due to climate change.

Glaciers exert a direct influence on the hydrologic cycle by slowing down the passage of water from the earth through the atmosphere and back. The Greenland Ice Sheet, with an estimated volume of 2.85 million cubic kilometers, ranks second only to Antarctica as the most massive ice body on the planet. Almost 2,400 kilometers long, Greenland's ice sheet has an average thickness of more than three kilometers.

Permafrost—soil, sediment, or rock that remains at or below 0° C for at least two years—occurs both on land and beneath offshore continental shelves and underlies about 22 percent of Earth's land surface. This frozen layer is generally continuous in the Arctic and more discontinuous in the sub-Arctic, but it is deteriorating significantly in many areas due to climate warming. (See also Climate Change section). There is little ice in non-porous bedrock, but ice is the main element of porous bedrock in stream valleys. The thickest layer of permafrost in continental Asia (300– 500 meters) is found in northeastern Yakutia; its temperature varies between -8° C and -12° C.

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