TUNDRA

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Introduction

The limit for arboreal vegetation, the trees are bare on the side that the wind blows. The flowering plants remain short, grass and moss and lichens survive better near the ground. This is the landscape of the Arctic zone in America, in Europe and Asia, where the climate is dry and cold. In the Arctic tundra the ground is frozen all year round, and can extend deeply for hundreds of metres. Reindeer, hares, Arctic foxes, ermines and numerous migrating species can be seen in the Arctic tundra.

Tundra biome

The word “tundra” comes from a Lapp word, meaning “barren land”. The area is flat, with scarce vegetation and virtually no rises: a cold desert. The climate of the tundra depends on the region being either oceanic or mainland. For instance, in the European tundra, which is heated by the Gulf Stream, the land is unfrozen for many months, while the Canadian mainland tundra is always frozen. In Europe, the tundra begins at 7°N latitude, while in eastern Canada is begins at 55°N. During the long winter, the monthly minimum temperatures never drop below -10°C in the European tundra and can reach -30°C in Alaska. In eastern Siberia, the average winter temperature can reach -50°C. Since the sun does not rise in winter, the tundra spends several months in long, cold darkness. Conversely, during the summer the sun is always, or almost always, above the horizon with no real nights. The solar energy that reaches the ground is in any case little, since the sun stays very low on the horizon. It ensues that the water trapped in the soil freezes down to many metres, forming a layer of hard soil, the surface of which thaws in summer only. The frozen soil of the tundra is called permafrost (from the English permanent frost). Evaporation is very low, therefore, even if it rains very little; nevertheless, the melting of the upper layers of soil form large wet areas during the Arctic summer.

The Tundra in the world

The biome of the tundra covers the northernmost lands of Europe, Siberia and north America. Overall, the tundra covers 5% of lands above sea level. Some areas of tundra can also be found at the southern end of south America. In the Austral hemisphere, large expanses of perennial ice cover Antarctica; mosses and lichens grow, however, in some very small areas along the borders of the mainland.

The mountains of the temperate areas - above 2.000 metres a.s.l. - do not have trees either, because of the cold, so they look like the tundra. This is the Alpine tundra, the so-called *parámo*, on the Andes. The Alpine tundra has some of the same plants as the real tundra, for instance dwarf willows, and some of the same species of insects. The Alpine tundra has no permafrost, day and night alternate every 24 hours and sunlight is more intense. Its typical animals are marmots, chamois, ptarmigans and chaffinches.

Plants of the tundra

The vegetation of the tundra is almost entirely composed of perennial plants, came phytic plants (cushion-like plants) and hemicryptophytic plants (perennial herbaceous plants). Cushion-like plants include Ericaceae and saxifrages, while hemicryptophytic plants include sedges. There are no forest trees at all. Shrubs, birches and willows are few and small, to resist frost and strong winds. Mosses, rushes, graminaceous plants and peat mosses (a type of moss which has adapted very well to live in swampy areas) grow in wet areas, where the land is soaked in water. In summer, many short-stemmed flowers deck the tundra in bright colours. Because of the cold, plants have a very slow growth cycle: the reindeer moss (*Cladonia rangiferina*), for instance, takes one year to grow just 1-5 mm taller.

Animals of the tundra

Despite the cold temperature, the tundra is inhabited by a lot of animal species. Many animals migrate to avoid the colder months. Others have developed, instead, different systems to defend themselves from the cold, through which they can survive in the tundra even during the long, cold winter night. In the tundra, animals cannot hibernate since the frozen soil cannot be dug up to make shelters or tunnels and because the warm season is too short to provide enough food to stock. Many small animals, such as the lemming, dig tunnels under the snow to look for food and to escape predators, but the ermine, a small carnivore with a nimble tapering body, can run after them even into their narrow tunnels. Arctic foxes hide stocks of frozen meat that they eat during the winter. Arctic hares take shelter under the snow, but feed above ground, thus risking to be attacked by wolves. Many of the species that stay in the tundra in winter, such as the willow capercaille, the Arctic fow, the Arctic hare and the ermine, change their colour to camouflage themselves. In summer, they have, therefore, dark and brown coats, while in winter they are snow-white. Most animals avoid the cold by migrating. In early summer, many species come back in droves from elsewhere: caribou, reindeers, grizzlies and grey wolves, for instance, come back from the boreal forests. Reindeers move in large herds; reindeer-does breed in early summer, as soon as they come back from the tundra. Grey wolves are also born in the warmer months, when they appear in the tundra as they run after large herbivores.

Birds of the tundra

The birds of the tundra are mostly migrant birds. Some of them, such as the greater willow chicken, move short distances away, while others travel for thousands of kilometres. The Arctic tern travels 36 thousand kilometres to reach the northern tundra from Antarctica! The goose is perhaps the most typical bird of the tundra. Many different species come here to breed after spending the cold months in the Mediterranean, Mexico, Africa or in the south of the United States. In summer, wet areas are the ideal place for many species of insects, that spend the winter as eggs. Mosquitoes and flies are so many as to force the big mammals, such as the musk ox and the caribou, to leave the swampy areas to reach higher, drier lands. The abundance of insects in the summer attracts to the

tundra very many species of insectivorous birds, which migrate there just to take part in the feast. Birds and lemmings attract pigeon hawks, falcons and other birds of prey.

The origin of tundra

The tundra as it looks today seems to have appeared on earth just two million years ago, before the succession of ice ages and following a general and lengthy cooling of the earth. The typical species of animals of plants that can be found in this biome must have come from high mountain areas. These organisms found a favourable habitat in the tundra, because it was like their native one. From mountain areas, the plants and animals that could resist cold and dry climates colonised the new desert and frozen habitat by perfectly adjusting to it. Whenever the Earth underwent some general cooling, the tundra expanded to lower-lying lands, from which it withdrew later, during warmer interglacial eras.

Man and tundra

The Samis, normally known as Lapps, live in a very wide territory stretching from the coasts of Norway to the peninsula of Kola, in Russia. They live in a particularly harsh environment in the heart of their lands: at Karesuando, in Sweden, the temperature may drop down to 45°C below zero. The Samis are nomadic shepherds and their economy is based on reindeer rearing. Their nomadic life is due to the reindeers' dietary needs. These big herbivores mainly feed on slowly-growing lichens, so they need very large areas to survive. The Lapps follow their animals, as they move in search of new pastures. The origin of the Samis is not perfectly known yet: some say they are European, while others say they come from Asia. The nomadic groups of Lapps still live in reindeer skin tents that look like those of native Americans. Dinner is their main meal. Traditional Sami dishes are mainly made of reindeer meat and fish. Reindeers are the only tamed animals. They were the basis of many people's economy, and entire Lapp families still live on what this big herbivore can offer. Food, hides, beverages, horns and bones, used to make tools, are obtained from reindeers. They are also used for transport.

Peoples of the tundra: the Ciukcis

Between the Pacific Ocean and the Arctic Sea, there is a roughly triangular peninsula, separated from Alaska by the Straits of Bering: it is the land of the Ciukcis. They seem to have come from north America across the thin strip of land which until 30 thousand years ago used to join Siberia to Alaska. Their economy is based on reindeer-rearing, hunting and fishing. Today, the Ciukcis are much fewer than in the past, and few of them continue to follow their traditional lifestyle. They used to be nomads for most of the year, following their reindeer herds towards new pastures. While the men travelled with their reindeers, the elderly used to build sleighs, while the women and the young used to tan hides, make garments and dry fish. Along the coast, the Ciukcik used to go hunting for whales, walruses and seals.

Energy from glaciers

Some areas covered by the biome of the tundra contain huge oil fields. In 1997, for instance, 162 million tons of oil were extracted from the subsurface of Siberia. Western Siberia alone contains over one half of the oil reserves of all Russia. Another important product supplied by the Russian tundra is methane. 220 billion cubic metres of gas are extracted every year, large part of which is channelled to Europe through methane pipelines measuring thousands of kilometres long. The methane that is used in Italy comes just from such ice-cold lands. The frozen soil of the tundra could supply a new source of energy: methane hydrates. They are composed of water and methane molecules, mixed and frozen together. They are contained in ocean sediments and in the Arctic permafrost. Hydrates contain a high concentration of methane, which could be extracted by a sort of “defrosting”. This operation is still difficult to carry out but is very interesting because a cubic metre of methane hydrate develops the same energy as by burning 135 kg of oil.

Possible threats

The tundra is an ecosystem substantially formed by frozen swamps and low biodiversity in terms of vegetation. However, it is one of the most sensitive habitats in the world, in fact, some scientists believe that global warming caused by the greenhouse effect can devastate the Arctic regions, including the tundra found within them. One third of the carbon present on the earth's soil is found in the permafrost of the tundra and therefore, when the frozen soil begins to melt, the organic content begins to decompose, releasing carbon dioxide into the air which increases the anthropogenic greenhouse effect. Additionally, permafrost melting could affect plant and animal species living in the tundra.

Long-distance pollution. Although remote and far away, the tundra is not spared the negative impact of some of man’s activities. Its most important problems have to do with the pollution which is caused by mining. The flowrate of the main Siberian rivers, the Lena and the Yenisey, has dramatically increased lately, despite the reduced rainfall. According to researchers, the water that swells up the rivers comes from the tundra. Recent studies actually showed the permafrost is getting thinner, probably because of the earth’s general overheating. In addition, the increased quantity of freshwater flowing into the Arctic Ocean could alter the salinity of the sea and endanger the life of the water ecosystems.

Natural parks of the tundra

The flora of the tundra is damaged by the passage of vehicles or even footfalls. Plants grow slowly, so they take long to recover. In addition, the destruction of bushes leaves the soil underneath more exposed to the sun, which makes it drier. A number of natural reserves, where man’s activities are controlled and restrained by law, have been established to preserve the biome of the tundra. One of the most important ones is the National Pallas Ounastunturi reserve, in the north of Finland. This reserve covers a surface of 500 square kilometres and includes two rocky plateaux of glacial origin: the Pallastunturi and the Ounastunturi. The word “tundra” comes from “tunturi”, which means “barren land”. The reserve is home to elks, wolverines, grizzlies, wolves and lynxes; there are many

variables or Arctic or white hares, weasels, lemmings and ermines. One of the oldest reserves in Finland is the Petkeljärvi sanctuary. Established in 1956, it covers approximately 6 square kilometres and since the antiquity this area has been considered one of the most beautiful ones in Finland. It is the ice that, during the latest ice age, has shaped and created such beautiful sights, producing isles, lakes, sandy beaches and isthmuses (strips of land). Water from molten ice left sand and pebbles, that built up into mounds, called eskers. It is a wild landscape of unique beauty, with open moors, small peat-bogs, swampy meadows and lakes covering approximately two thirds of the overall surface of the sanctuary. If, on one hand, its location at the border with Russia allowed it to remain in a wild state, on the other hand the Second World War brought battles here that damaged it. When walking through it, some small trenches and fortifications are still visible and have now been restored and turned into tourist attractions. The sanctuary is the domain of elks, although it is also home to a good number of pine martens, lynxes, beavers and many species of birds.

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