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The word tundra is believed derivating from the Finnish word "*tunturia*" which refers to a treeless plain.

The tundra is characterized from the presence of **permafrost**, a layer of permanently frozen ground just below the surface.

Tundra ecosystems are found where cold, hard winds and/or permafrost prevent the growth of large woody plants.

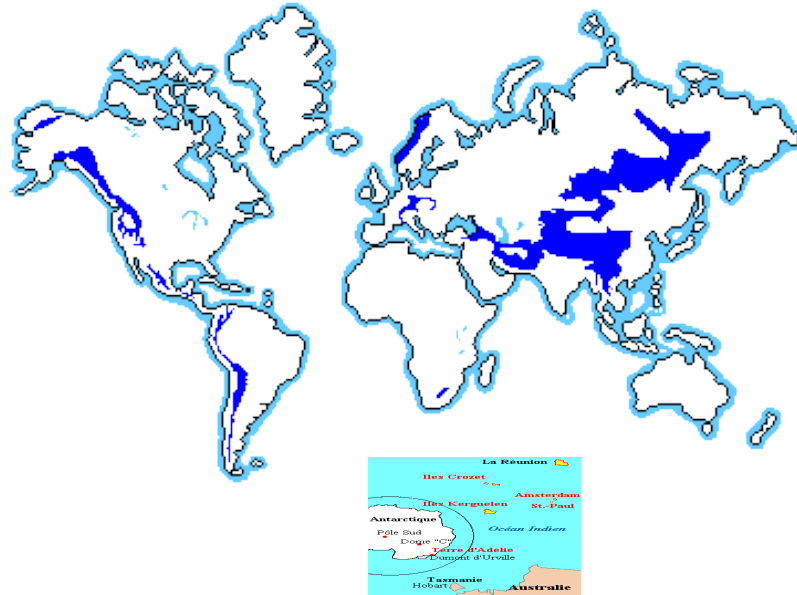
We recognize two types of tundra:

Arctic tundra

Alpine tundra

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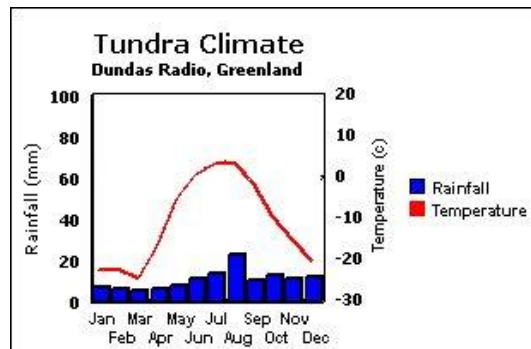
Tundra (Arctic and Alpine)



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CLIMATE

In the arctic tundra there are two seasons: winter and summer. In the summer, the sun is present almost 24 hours a day. This sun however, only warms the tundra up to a range of about 3°C to 12°C. In the winter the opposite light conditions are present. There are several weeks where the sun never rises. This causes the temperatures to drop to extremely cold levels. The average temperature of the tundra is around -28°C while extremes can dip to -70°C.



Precipitation levels in the tundra are from 6 to 10 inches a year. Most of this falls as snow. In many ways this biome is a cold desert, lacking significant precipitation.

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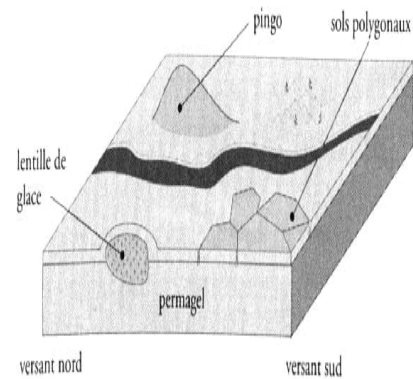
However, despite the lack of rain or snow, the tundra is characterized by the presence of a lot of standing water. This is the result of the permafrost: each summer, the upper layer melts just enough to create small bogs and pools. The water will not soak into the ground however, because the permafrost blocks it. In the winter these pools freeze and the cycle repeats itself. Very little moisture is lost to evaporation.

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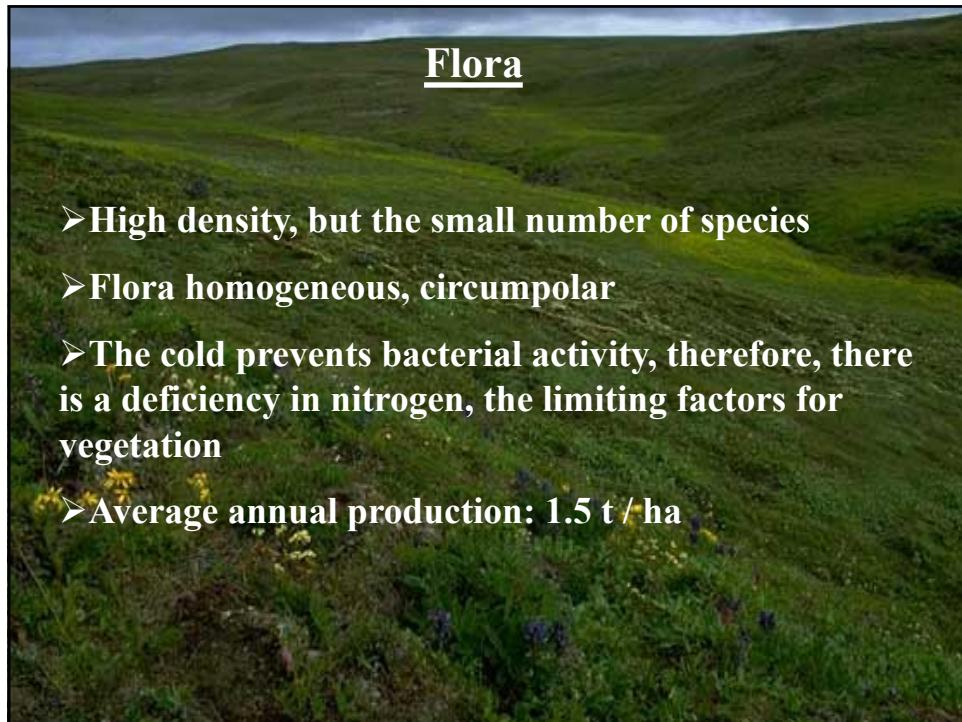
SOIL

All the processes are very slow:
physical pedogenic factors more important than chemical factors; the rocks do not undergo great erosion, while frequent are the phenomena of solifluction cryoturbation that create figures: pingos, palsa, soil polygons, gley soil.

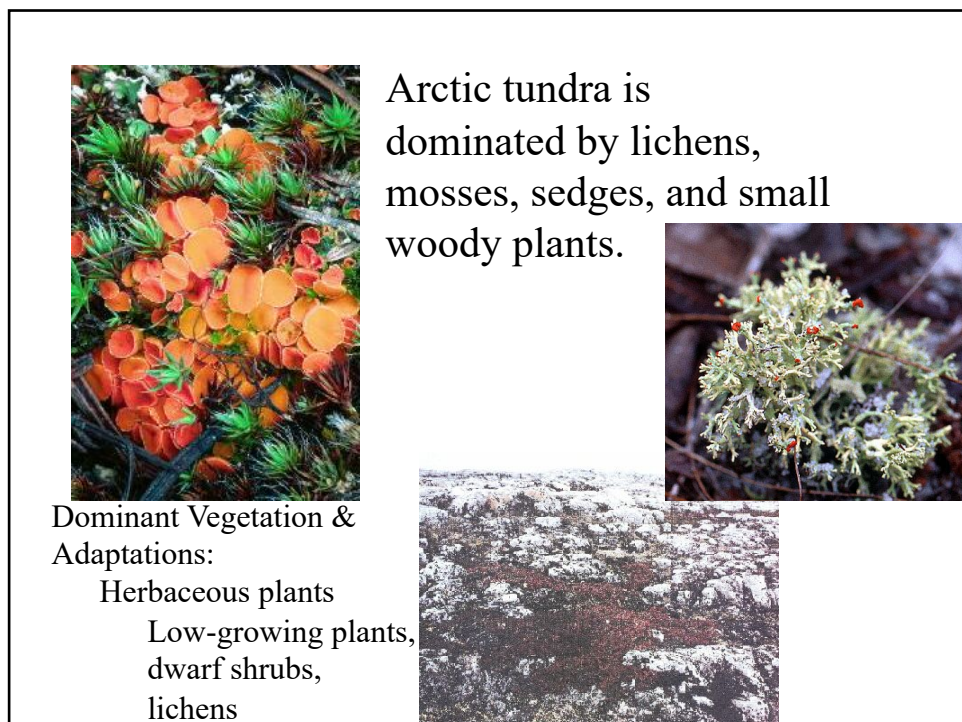
bacterial activity very low



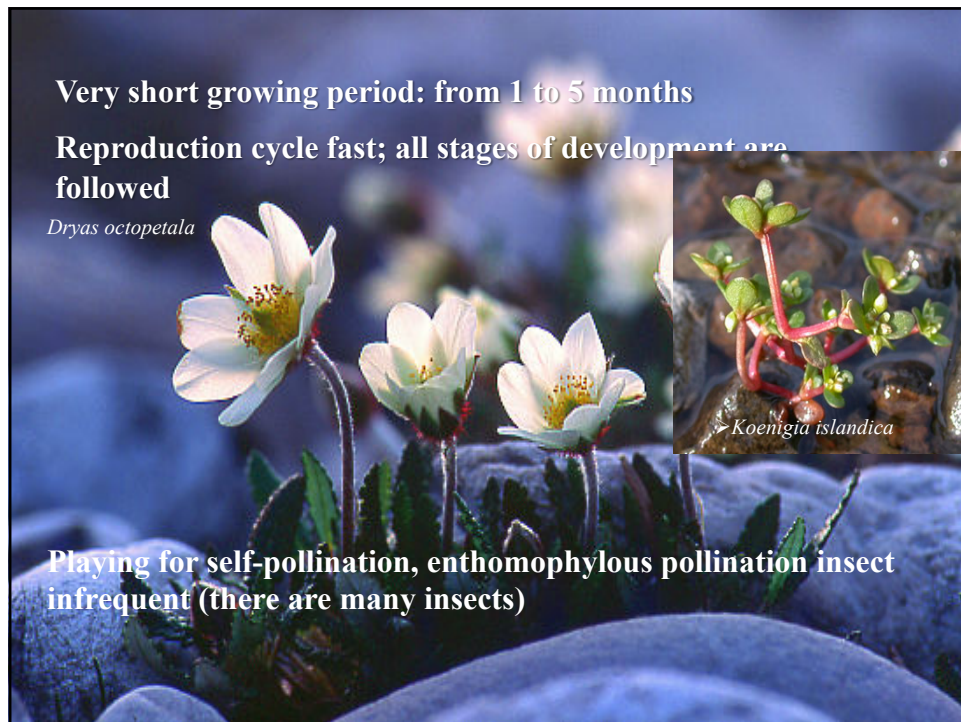
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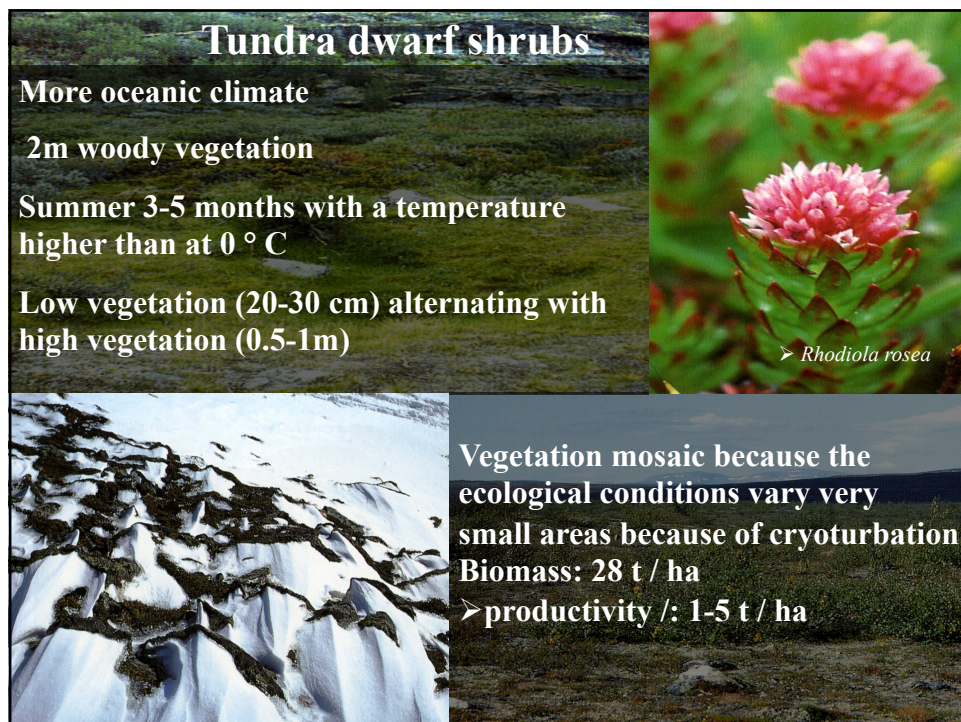
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Tundra wooded

Alternating trees (*Picea mariana* and larch) and shrub vegetation and lichens typical of tundra.



Progressive thinning due to permafrost and drought

Biomass of 137 t / ha

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FAUNA

Many animals migrate to the tundra in the summer months to take advantage of the lack of predators, abundant plants, insects, and fish. Snowy Owls breed on the ground in the summer months; predate voles, lemmings and other small rodents. Musk oxen, a smaller cousin of the Ox feeds on the grasses in small herds. They defend themselves from one of the few predators, packs of wolves.

Caribou (reindeer), migratory waterfowl, arctic wolf, arctic fox, musk oxen, snowy owl



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The large herbivores (reindeer, caribou, musk ox) leave bare grasslands which take a long time to regenerate. migratory animals.



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Alpine Tundra



This biome can be found at any latitude on earth. Its only dependent on elevation. Elevational treelines vary with latitude, being:

900 m at 65°N

2100 m at 49°N

3300 m at 40°N

4200 m at 19°N

Soils lack permafrost but are thin and "new". Well drained (water runs downslope and does not pool) and summer droughts can occur.

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Alpine tundra
is found high in
mountains at all
latitudes.

Conditions are
variable.

Permafrost is
rare.



The alpine tundra is not a homogenous zone where plants have equal opportunity to grow. Small changes in elevation in this zone and patches of snow and rock create microhabitats where different species of plant and animal can specialize.

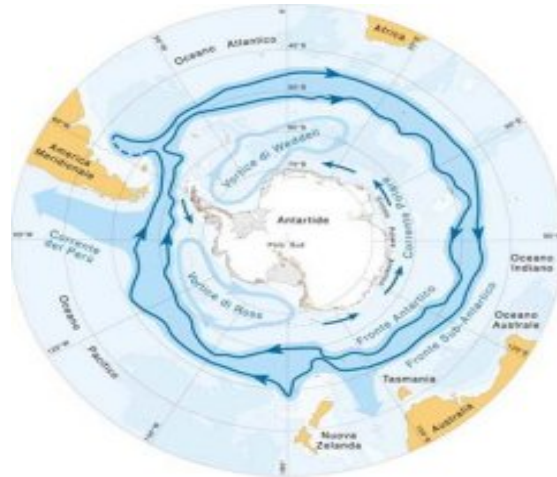
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ANTARTIC

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Antarctic Ocean

ADJUSTMENT OF CLIMATE A GLOBAL SCALE
CURRENT THROUGH the Antarctic



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CLIMATE

Summer temperatures from 0°C to -32°C in the coastal area of the continental

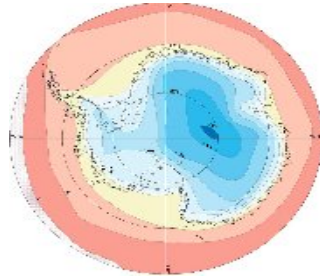
Winter temperatures from -20°C to -70°C in the coastal area of the continental

130 mm annual rainfall (500 mm of the Antarctic Peninsula to 50 mm in the continental zone)

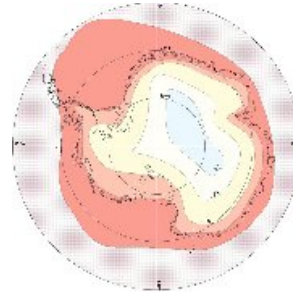
In summer (October-February) the continent is always lit in the winter (March-September) always in the dark

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CLIMATE



**AVERAGE TEMPERATURES
WINTER**



**AVERAGE TEMPERATURES
SUMMER**

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HABITAT

3 MAIN TYPES OF HABITAT:

- Area with the substrate free of permanent ice with frequent rainfall
- Area with winter ice that melts in summer
- Area with permafrost

The plant grow on permafrost

In areas without ice there is availability of liquid water

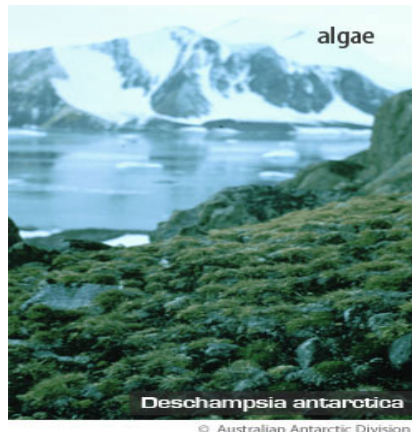


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FLORA

PLANT SPECIES IDENTIFIED:

- 2 species of angiosperms (Antarctic Peninsula)
- 300 species of algae
- 200 species of lichens
- 200 species of mosses
- 25 species of Hepatics
- 28 species of fungi



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ANGIOSPERMAE

two spermatophyte species have colonized Antarctica :

Deschampsia antarctica (Poaceae)

• **Colobanthus quietensis** (Caryophyllaceae)



D.Antarctica



C.quietensis

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ALGAE SNOW

Algae are living in areas of permanent or semi-permanent snow that can reach high concentrations in the summer months and form benches

snow red,
orange, green
and gray



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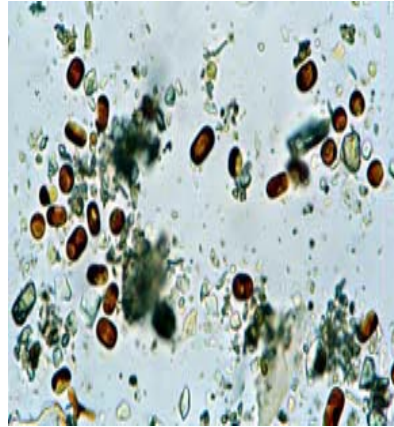


Chloromonas rubroleosa

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Chlamydomonas nivalis



Mesotaenium berggren

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ALGAE

constitute the phytoplankton that grows in the summer are behind the marine food webs



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LICHENS

The rainfall, the katabatic winds and melting ice are a source of moisture necessary for the growth of lichens and attenuate the concentration of salts

Xanthoria elegans (red)
Buellia frigida (black)



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BRYOPHYTES



Bryum subrotundifolium (green)
Ceratodon purpureus (red)

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Current Status

The Antarctic Treaty was signed in 1959 and now holds signatures of 44 nations. The treaty applies to the area south of 60° south latitude, including all islands and ice shelves. It includes prohibitions on the killing, wounding, capturing or molesting of any native mammal or native bird—except in accordance with a permit—as well as regulations on the importation of exotic species, parasites, and diseases. Permits may only be issued by persons authorized by a participating government. Also, numerous conservation areas are designated in several categories, and carry further regulations. For example, vehicles are prohibited to enter Specially Protected Areas.

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The Antarctic Treaty has, for the time being, put a ban on any Antarctic nuclear testing, radioactive waste disposal, and oil or other mineral drilling. It does not, however, prevent environmental degradation altogether. Much of the Antarctic ecosystem, particularly its flora, is extremely vulnerable to even the slightest disturbance. Several thousand researchers and tourists visit the continent each year. While the majority of tourism is concentrated at the more accessible Antarctic Peninsula, it is a growing industry on the continental portion, corresponding with the rising interest in adventure tours.

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As the last relatively unspoiled continent on the planet, conservation in Antarctica is far more organized and effective than anywhere else on Earth. Potential future threats to the Antarctic environment would likely result from activities undertaken far from the isolated wilderness. The dramatic loss of ozone in the atmosphere over Antarctica was first noticed by the British Antarctic Survey over Halley Station in Queen Maud Land in 1984. It is believed to be the result of widespread use of CFC's (chlorofluorocarbons) as cooling agents. This possibility had been raised in the 1970's, and restrictions had been put on the use of CFC's. However, their persistence in the atmosphere, combined with the unique circulation in the stratosphere that is centered over the stable Antarctic vortex, led to this unexpected, massive depletion of ozone.

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A smaller hole was found in the Arctic, though its vortex is less stable, producing conditions less likely to create an ozone hole. Though UV-B radiation accounts for less than 1% of the Earth's total sunlight, it has the ability to damage organisms by disrupting basic biological processes. It is also a well-known contributor to the development of skin cancer. The study of lichens in Antarctica, which are adapted to high levels of UV-B radiation, may lead to beneficial discoveries. Certain species of lichens (e.g. *Usnea aurantiaco-atra*) produce higher levels of usnic acid when levels of UV-B are higher. Usnic acid levels in old lichen specimens from herbariums show lower levels of usnic acid than recent specimens from the same place, indicating that UV-B levels were lower in recent history.

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Global warming, as a result of human production of greenhouse gases, threatens to melt large amounts of the ice that makes up most of the Antarctic. Were this to take place rapidly, flora and fauna highly adapted to the particular conditions of polar regions could be drastically disrupted, for example in the case mentioned earlier with the emperor penguin. The continent of Antarctica cannot be considered as entirely separate from the populated portions of the Earth. The polar region play a key role in worldwide weather patterns. To an extent, the polar seas act as 'heat sinks', partially counteracting the greenhouse effect from build-up of carbon dioxide in the atmosphere. Changes in climate in Antarctica would certainly carry tangible effects to the populated continents of the planet.

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