## The Tundra



The word **tundra** derives from the Finnish word for barren or treeless land. The tundra is the simplest biome in terms of species composition and food chains.

**Vegetation:** <u>lichens</u>, mosses, <u>sedges</u>, <u>perennial forbs</u>, and <u>dwarfed shrubs</u>, (often <u>heaths</u>, but also birches and willows).

**Growthforms:** typical are ground-hugging and other warmth-preserving forms including:

- tussock-forming graminoids
- <u>mats or cushion plants</u>, often evergreen members of the heath family
- <u>rosettes</u>
- dwarf shrubs, some of which are deciduous in habit

**Climate:** The high latitude conditions of Koeppen's ET climate type that impact life in this biome include

- extremely short growing season (6 to 10 weeks)
- long, cold, dark winters (6 to 10 months with mean monthly temperatures below 32° F or 0° C.)
- low precipitation (less than five inches/year) coupled with strong, drying winds. Snowfall is actually advantageous to plant and animal life as it provides an insulating layer on the ground surface.

**Edaphic controls:** Permafrost, not cold temperatures *per se*, is generally believed to be what prevents tree growth. Furthermore, freeze-thaw activity, a thin active layer, and solifluction during the warmer months contribute to strong controls on vegetation patterns and create a mosaic of microhabitats and plant communities.

Soil: No true soil is developed in this biome due to the edaphic factors mentioned above.

**Fauna:** Strategies evolved to withstand the harsh conditions of the tundra can be divided among those species that are resident and those that are migratory.

• Among the small number of bird (e.g., ptarmigan) and mammal (e.g., muskox, arctic hare, arctic fox, musk ox) species that reside year-round on the tundra one commonly finds:

Morphological adaptations

- large, compact bodies following Bergmann's and Allen's rules
- a thick insulating cover of feathers or fur
- pelage and plumage that turns white in winter, brown in summer

Physiological adaptations

 ability to accumulate thick deposits of fat during the short growing season. Fat acts as insulation and as a store of energy for use during the winter, when animal species remain active.

Population adaptations

- cyclical fluctuations in population size, best seen perhaps in the lemming, a small rodent which is the major herbivore in the tundra's simple food chain. Predator populations and plant populations respond in kind to the peaks and crashes of the herbivore populations.
- Migratory species such as waterfowl, shorebirds and caribou adapt to the tundra by avoiding the most severe conditions of winter. Each year at the end of the short growing season they move southward into the boreal forest or beyond, but return to the tundra to breed.

Aperiodic emigration from the tundra is exhibited by the snowy owl during those years that the lemming populations have crashed. Those winters see snowy owl irruptions as far south as Virginia. Most owls are found with empty stomachs and do not survive to return to the Arctic.

**Distribution:** The tundra biome is restricted to the high latitudes of the northern hemisphere in a belt around the Arctic Ocean. Many of its species, both plant and animal, have circumpolar distribution areas.

Within the tundra biome a latitudinal zonation of communities is realized:

• **High Arctic Tundra:** essentially confined to the islands of the Arctic Ocean and characterized by scattered lichens and mosses on care rock surfaces and perennial forbs growing in protected crannies among sharp, ice-fractured rock debris.

- **Middle Arctic Tundra:** restricted to the Arctic Coastal plain where level terrain, a thin active layer, and freeze and thaw result in <u>patterned ground</u>, or rock polygons. The sorting of particles by freeze-thaw activity results in a waterlogged center to the polygons, a microhabitat conducive to sphagnum moss and sedges; and an outer ring that is drier and provides a microhabitat favorable to forbs and some dwarf heaths.
- Low Arctic Tundra: the majority of the tundra lies on better drained slopes with greater depth to permafrost than is encountered on the Arctic coastal plain. Here there is a greater frequency of woody shrubs: willow, birch, and various berrybearing members of the heath family. Along streams willows and alders may be 10 feet high. On south-facing slopes needleleaf evergreen trees (spruce and fir) are established and represent the northernmost extensions of the great boreal forest to the south. (Such areas where two biomes interdigitate are known as ecotones.)

## **Alpine Tundra**

Many tundra species can be found at high elevations in the mountains of the northern hemisphere. The <u>arctic-alpine lifezone</u> of high elevations experiences a different climate--in terms of daylength and seasons--than does the true tundra of the Arctic. However, thin soils and cold temperatures create an environment that many middle latitude trees cannot tolerate and thus allow tundra species to invade and thrive.

In the tropics, the climate of very high elevations is extremely different than that of the Arctic. Freeze-thaw, instead of following a seasonal cycle, follows a diurnal cycle. Also, the peaks are isolated from the Arctic tundra. Often endemic species derived from a tropical flora or from Antarctic flora create the unique communities of tropical high mountain tops. See <u>Tropical Lifezones</u> for additional information and some photographs of the giant lobelias and groundsels of Mt. Kenya.

http://www.radford.edu/~swoodwar/CLASSES/GEOG235/biomes/intro.html