

Sources that DO apply the word “tundra” to alpine vegetation

- Weber, William A. and Ronald C. Wittman, *Colorado Flora: Eastern Slope*, University Press of Colorado, 1996
On p. xvi talks about visiting Mt. Evans and the “wet tundra” there as being like a vicarious visit to the Arctic
- Kershaw, Linda, , Andy MacKinnon and Jim Pojar, *Plants of the Rocky Mountains*, Lone Pine, 1998
Describes Alpine(Tundra) as one of the life zones
- Nelson, Ruth Ashton, revised by Roger L. Williams, *Handbook of Rocky Mountain Plants*, 4th ed., 1992. Describes Alpin (Tundra) as one of the lifezones.
- Oosting, Henry J. *The Study of Plant Communities*, WH Freeman, 1956
Climax Regions of North America
Uses both Alpine tundra and Arctic tundra
- Takhtajan, Armen, *Floristic Regions of the World*, Univ. of Calif. Press, 1986
(35 floristic regions)
Uses the term alpine tundra as well as arctic
- Dansereau, Pierre, *Biogeography: An Ecological Perspective*, Ronald Press, 1957
Uses word tundra for high altitude plant communities
- Benson, Lyman, *The Cacti of the United states and Canada*, Stanford Univ. Press, 1982,
chpt 10 The Floras and Floristic Associations of North America
Uses both arctic and alpine tundra

ONLINE SOURCES

Wikipedia

Describes two types of tundra – arctic and alpine

University of California Museum of Paleontology

<http://www.ucmp.berkeley.edu/exhibits/biomes/tundra.php>

Section on world biomes – tundra, uses both arctic and alpine tundra

Blue Planet biomes

<http://www.blueplanetbiomes.org/tundra.htm>

both alpine and arctic tundra

Sources that do NOT apply the word “tundra” to alpine vegetation

Simmons, Ian, *Biogeographical Processes*, George Allen, 1982

pp 36-40 describes tundra as:

Arctic and fringe Antarctic and Subantarctic islands (no mention of alpine)
Underlain by permafrost

Collinson, A. S. *Introduction to World Vegetation*. George Allen, 1978., p 179 in chapter High Latitude and High Altitude Vegetation says:

“In middle latitudes, the alpine stages on high mountains are comparable in many ways, floristically and physiognomically, to the vegetation near sea level in the low Arctic and there are many common species represented as latitudinal ecotypes... However, important differences in energy conditions and other factors at work in the two ecosystems make direct comparison impossible.

Cox, C. Barry & Peter D. Moore, *Biogeography, an ecological and evolutionary approach*, 3rd ed., Blackwell Scientific Publications, 1980, pp 48-49

Arctic tundra – permafrost and short growing season
No mention of alpine

De Laubenfels, David, *A Geography of Plants and Animals*, Wm C. Brown Co., 1970, says on p. 99 in discussing the development of vegetation classification:

“The tundra was also certified as a vegetation type although it represents a variety of formations, none unique, but all without trees. Tundra may make sense as a climatic type but does not deserve to be labeled as a unique vegetation type.”

Chabot, Brian F., & Mooney, Harold A. *Physiological Ecology of North American Plant Communities*, Chapman and Hall, 1985

Chpt 2 *Arctic* – F Stuart Chapin III and Gaius R. Shaver
Describe as tundra

Chpt 3 *Alpine*-L.C. Bliss

Does not use the word tundra

Barbour, Michael G. & William Dwight Billings eds., *North American Terrestrial Vegetation*, Cambridge University Press, 1988.

p. 392 “There is a tendency among some ecologists in North America to speak of ‘alpine tundra’ and to equate this with the true tundra of the Arctic. Although it is tempting to accept this equivalence, from the standpoints of environment, flora and vegetation it is only partly true...only low temperatures during the growing season are held in common by the Arctic tundra of the Far North and the alpine ecosystems of the Rocky Mountains near 40° N latitude”.

Bailey, *Description of the Ecoregions of the United States*, USDA, Forest Service, Ogden Utah, 1978 to accompany map)

pp.3-6

Polar Domain

Arctic tundra province (1210)

Bering tundra province (1220)

Does not include alpine—though it is important to note that alpine tundra would be virtually impossible to map at the scale of this map

ONLINE SOURCES

World Wildlife Fund website – Ecoregions

http://www.panda.org/about_wwf/where_we_work/ecoregions/about/habitat_types/selecting_terrestrial_ecoregions/habitat11.cfm

Two types of arctic tundra, but not alpine – however, this is to accompany a very small scale map on which alpine tundra could not be mapped

Tundra

From Wikipedia, the free encyclopedia

In physical geography, **tundra** is an area where the tree growth is hindered by low temperatures and short growing seasons. The term "tundra" comes from Kildin Sami *tūndâr* 'uplands, tundra, treeless mountain tract'. There are two types of tundra: Arctic tundra (which also occurs in Antarctica), and alpine tundra^[1]. In tundra, the vegetation is composed of dwarf shrubs, sedges and grasses, mosses, and lichens. Scattered trees grow in some tundra. The ecotone (or ecological boundary region) between the tundra and the forest is known as the tree line or timberline.

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Arctic tundra



Map of arctic tundra



Tundra in Greenland

Arctic tundra occurs in the far Northern

Hemisphere, north of the taiga belt. The word "tundra" usually refers only to the areas where the subsoil is permafrost, or permanently frozen soil. (It may also refer to the treeless plain in general, so that northern Sápmi would be included.) Permafrost tundra includes vast areas of northern Russia and Canada^[1]. The polar tundra is home to several peoples who are mostly nomadic reindeer herders, such as the Nganasan and Nenets in the permafrost area (and the Sami in Sápmi).

The Arctic tundra is a vast area of stark landscape, which is frozen for much of the year. The soil there is frozen from 25-90 cm (9.8-35.4 inches) down, and it is impossible for trees to grow. Instead, bare and sometimes rocky land can only support low growing plants such as moss, heath, and lichen. There are two main seasons, winter and summer, in the polar Tundra areas. During the winter it is very cold and dark, with the average temperature around -28 °C (-18.4°F), sometimes dipping as low as -50 °C (-58°F). However, extreme cold temperatures on the tundra do not drop as low as those experienced in

Biomes
Terrestrial biomes
Tundra
Taiga/boreal forests
Temperate broadleaf and mixed forests
Temperate coniferous forests
Tropical and subtropical moist broadleaf forests
Tropical and subtropical dry broadleaf forests
Tropical and subtropical coniferous forests
Tropical and subtropical grasslands, savannas, and shrublands
Temperate grasslands, savannas, and shrublands
Montane grasslands and shrublands
Deserts and xeric shrublands
Mediterranean forests, woodlands, and shrub
Mangrove
Aquatic biomes
Continental shelf
Littoral/intertidal zone
Riparian
Pond
Coral reef
Kelp forest
Pack ice
Hydrothermal vents

taiga areas further south (for example, Russia's and Canada's lowest temperatures were recorded in locations south of the treeline). During the summer, temperatures rise somewhat, and the top layer of the permafrost melts, leaving the ground very soggy. The tundra is covered in marshes, lakes, bogs and streams during the warm months. Generally daytime temperatures during the summer rise to about 12°C (53.6°F) but can often drop to 3°C (37.4°F) or even below freezing. Arctic tundras are sometimes the subject of habitat conservation programs. In Canada and Russia, many of these areas are protected through a national Biodiversity Action Plan.

Cold seeps
Benthic zone
Pelagic zone
Neritic zone
Other biomes
Endolithic zone

The tundra is a very windy area, with winds often blowing upwards at 48–97 km/h (30-60 miles an hour). However, in terms of precipitation, it is desert-like, with only about 15–25 cm (6–10 inches) falling per year (the summer is typically the season of maximum precipitation). During the summer, the permafrost thaws just enough to let plants grow and reproduce, but because the ground below this is frozen, the water cannot sink any lower, and so the water forms the lakes and marshes found during the summer months. Although precipitation is light, evaporation is also relatively minimal.

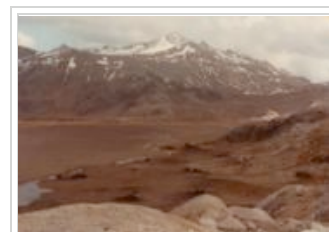
The biodiversity of the tundras is low: 1,700 species of vascular plants and only 48 land mammals can be found, although thousands of insects and birds migrate there each year for the marshes. There are also a few fish species such as the flat fish. There are few species with large populations. Notable animals in the Arctic tundra include caribou (reindeer), musk ox, arctic hare, arctic fox, snowy owl, lemmings, and polar bears (only the extreme north) ^[2].

Due to the harsh climate of the Arctic tundra, regions of this kind have seen little human activity, even though they are sometimes rich in natural resources such as oil and uranium. In recent times this has begun to change in Alaska, Russia, and some other parts of the world.

Another concern is that about one third of the world's soil-bound carbon is in taiga and tundra areas. When the permafrost melts, it releases carbon in the form of carbon dioxide, a greenhouse gas. The effect has been observed in Alaska. In the 1970s the tundra was a carbon sink, but today, it is a carbon source^[3].

Antarctic tundra

Antarctic tundra occurs on Antarctica and on several Antarctic and subantarctic islands, including South Georgia and the South Sandwich Islands and the Kerguelen Islands. Antarctica is mostly too cold and dry to support vegetation, and most of the continent is covered by ice fields. However, some portions of the continent, particularly the Antarctic Peninsula, have areas of rocky soil that support plant life. The flora presently consists of around 300-400 lichens, 100 mosses, 25 liverworts, and around 700 terrestrial and aquatic algae species, which live on the areas of exposed rock and soil around the shore of the continent. Antarctica's two flowering plant species, the Antarctic hair grass (*Deschampsia Antarctica*) and Antarctic pearlwort (*Colobanthus quitensis*), are found on the northern and western parts of the Antarctic Peninsula^[4] In contrast with the Arctic tundra, the Antarctic tundra lacks a large mammal fauna, mostly due to its physical isolation from the other continents. Sea mammals and sea birds, including seals and penguins, inhabit areas near the shore, and some small mammals, like rabbits and cats, have been introduced by humans to some of the subantarctic islands.



Tundra on the Péninsule Rallier du Baty, Kerguelen Islands

The flora and fauna of Antarctica and the Antarctic Islands (south of 60° south latitude) are protected by the Antarctic Treaty.^[5]

Tundra also occurs on Tierra del Fuego and southern Argentina.^[6] Notable plant and lichen species of this tundra include *Neuropogon aurantiaco*, *Azorella lycopodioides*, *Marsippospermum reichei*, *Nardophyllum bryoides*, and *Bolax gummifera*.

Alpine tundra

Alpine tundra is an ecozone that does not contain trees because it has high altitude. Alpine tundra occurs at high enough altitude at any latitude on Earth. Alpine tundra also lacks trees, but the lower part does not have permafrost, and alpine soils are generally better drained than permafrost soils. Alpine tundra transitions to subalpine forests below the tree line; stunted forests occurring at the forest-tundra ecotone are known as *Krummholz*. Alpine tundra occurs in an **alpine zone**.

Alpine tundra does not map directly to specific World Wide Fund for Nature ecoregions. Portions of Montane grasslands and shrublands ecoregions include alpine tundra.

Because alpine tundra is located in various widely-separated regions of the Earth, there is no animal species common to all areas of alpine tundra. Some animals of alpine tundra environments include the Kea parrot, marmot, Mountain goats, chinchilla, and pika.

Large sections of the Tibetan Plateau include alpine tundra.

See also: Tree line

Climatic classification

See also: *Alpine climate*

Tundra climates ordinarily fit the Köppen climate classification **ET**, signifying a local climate in which at least one month has an average temperature high enough to melt snow (0°C or 32°F), but no month with an average temperature in excess of (10°C/50°F). The cold limit generally meets the **EF** climates of permanent ice and snows; the warm-summer limit generally corresponds with the poleward or altitudinal limit of trees, where they grade into the subarctic climates designated **Dfd** and **Dwd** (extreme winters as in parts of Siberia), **Dfc** typical in Alaska, Canada, European Russia, and Western Siberia (cold winters with months of freezing), or even **Cfc** (no month colder than -3°C as in parts of Iceland and southernmost South America). Tundra climates as a rule are hostile to woody vegetation even where the winters are comparatively mild by polar standards, as in Iceland.

Despite the potential diversity of climates in the **ET** category involving precipitation, extreme temperatures, and relative wet and dry seasons, this category is rarely subdivided. Rainfall and snowfall are generally slight due to the limited capacity of the chilly atmosphere to hold water vapor, but as a rule potential evapotranspiration is extremely low, allowing soggy terrain of swamps and bogs even in places that get precipitation typical of deserts of lower and middle latitudes. Scarcity or lushness (by polar standards) of native vegetation of tundra regions depends more upon the severity of the temperatures than upon the scarcity or copiousness of precipitation. The alpine tundra also lacks in precipitation compared to the Arctic tundra.

References

- [^] ^{*a b*} The Tundra Biome (<http://www.ucmp.berkeley.edu/glossary/gloss5/biome/tundra.html>) . *The World's Biomes*. Retrieved on 2006-03-05.
- [^] Tundra (<http://www.blueplanetbiomes.org/tundra.htm>) . *Blue Planet Biomes*. Retrieved on 2006-03-05.
- [^] W. C. Oechel et al (11 February 1993). "Recent change of Arctic tundra ecosystems from a net carbon dioxide sink to a source". *Nature* **361**: 520-523.
- [^] Terrestrial Plants (http://www.antarctica.ac.uk/About_Antarctica/Wildlife/Plants/index.html) . *British Antarctic Survey: About Antarctica*. Retrieved on 2006-03-05.
- [^] Protocol on Environmental Protection to the Antarctic Treaty



Hikers traversing the Franconia Ridge in the White Mountains of New Hampshire, much of which is in the **alpine zone**.

(http://www.antarctica.ac.uk/About_Antarctica/Treaty/protocol.html) . *British Antarctic Survey: About Antarctica*. Retrieved on 2006-03-05.

6. ^ Brancaloni, Lisa; Jorge Strelin, Renato Gerdol (2003). "Relationships between geomorphology and vegetation in subantarctic Andean tundra of Tierra del Fuego". *Polar biology* **26** (6): 404-410.

See also

- List of tundra ecoregions from the WWF
- Fellfield
- Steppe-tundra
- Forest-tundra

External links

- WWF Tundra Ecoregions (http://www.panda.org/about_wwf/where_we_work/ecoregions/about/habitat_types/selecting_terrestrial_ecoregions/habitat11.cfm)
- The Arctic biome at Classroom of the Future (<http://www.cotf.edu/ete/modules/mseese/earthsysflr/tundra.html>)
- Arctic Feedbacks to Global Warming: Tundra Degradation in the Russian Arctic (<http://www.ulapland.fi/home/arktinen/tundra/tundra.htm>)
- British Antarctica Survey (http://www.antarctica.ac.uk/about_antarctica/wildlife/plants/)

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Categories: Terrestrial biomes | Arctic | Climate

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