**TAIGA**

**Taiga**, also called **boreal forest**, [biome](https://www.britannica.com/science/biome) (major life zone) of vegetation composed primarily of cone-bearing needle-leaved or scale-leaved [evergreen](https://www.britannica.com/plant/evergreen-plant) [trees](https://www.britannica.com/plant/tree), found in northern circumpolar forested regions characterized by long [winters](https://www.britannica.com/science/winter) and moderate to high annual [precipitation](https://www.britannica.com/science/precipitation). The taiga, “land of the little sticks” in Russian, takes its name from the [collective](https://www.merriam-webster.com/dictionary/collective) term for the northern [forests](https://www.britannica.com/science/forest) of [Russia](https://www.britannica.com/place/Russia), especially [Siberia](https://www.britannica.com/place/Siberia).

The taiga, which is also known as the boreal (meaning northern) [forest](https://www.britannica.com/science/forest) region, occupies about 17 percent of [Earth](https://www.britannica.com/place/Earth)’s land surface area in a circumpolar belt of the far [Northern Hemisphere](https://www.britannica.com/topic/Northern-Hemisphere). Northward beyond this limit, the taiga merges into the circumpolar [tundra](https://www.britannica.com/science/tundra). The taiga is characterized predominantly by a limited number of [conifer](https://www.britannica.com/plant/conifer) species—i.e., [pine](https://www.britannica.com/plant/pine) (*Pinus*), [spruce](https://www.britannica.com/plant/spruce) (*Picea*), [larch](https://www.britannica.com/plant/larch) (*Larix*), [fir](https://www.britannica.com/plant/fir) (*Abies*)—and to a lesser degree by some deciduous genera such as [birch](https://www.britannica.com/plant/birch) (*Betula*) and [poplar](https://www.britannica.com/plant/poplar) (*Populus*). These trees reach the highest latitudes of any trees on [Earth](https://www.britannica.com/place/Earth). [Plants](https://www.britannica.com/plant/plant) and [animals](https://www.britannica.com/animal/animal) in the taiga are adapted to short growing [seasons](https://www.britannica.com/science/season) of long days that vary from cool to warm. Winters are long and very cold, the days are short, and a persistent snowpack is the norm. The taiga biomes of [North America](https://www.britannica.com/place/North-America) and [Eurasia](https://www.britannica.com/place/Eurasia) display a number of similarities, even sharing some plant and animal [species](https://www.britannica.com/science/species-taxon).

**Origin**

During the final period of maximum cold [temperatures](https://www.britannica.com/science/temperature) (23,000 to 16,500 years ago) in the latter part of the [Pleistocene](https://www.britannica.com/science/Pleistocene-Epoch) Ice Age (which ended 11,700 years ago), species that now [constitute](https://www.merriam-webster.com/dictionary/constitute) the taiga were displaced as far south as 30° N latitude by the continental [glaciers](https://www.britannica.com/science/glacier) of [Europe](https://www.britannica.com/place/Europe), [Asia](https://www.britannica.com/place/Asia), and North America and by the hyperarid and extremely cold [environments](https://www.merriam-webster.com/dictionary/environments) of unglaciated Asia and North America. As the glaciers began to retreat gradually about 18,000 years ago, species of the taiga began to move northward in Europe and North America. In eastern and central North America the northward movement of the forest was relatively steady and gradual. An exception to this progression occurred about 9,000 years ago in western [Canada](https://www.britannica.com/place/Canada), when [white spruce](https://www.britannica.com/plant/white-spruce) spread rapidly northward across 2,000 km (1,240 miles) of newly deglaciated land in only 1,000 years. This rapid migration resulted from seed dispersal [facilitated](https://www.merriam-webster.com/dictionary/facilitated) by strong northward winds caused by clockwise [atmospheric circulation](https://www.britannica.com/science/atmospheric-circulation) around the remnant ice cap of northern Quebec and the western part of [Hudson Bay](https://www.britannica.com/place/Hudson-Bay).

Because so much of Earth’s water was bound up in ice at this time, sea levels were lower than they are today, and this allowed migrations of various terrestrial species to occur. Many areas that are now islands were then connected to the nearby mainland; e.g., the [British Isles](https://www.britannica.com/place/British-Isles) were linked to Europe. As the [climate](https://www.britannica.com/science/climate-meteorology) warmed during the last stages of the glacial period, but before the [sea level](https://www.britannica.com/science/sea-level) rose to its current position, some plants and animals of the mainland European taiga [ecosystem](https://www.britannica.com/science/ecosystem) migrated to Britain. This biota exists today as part of the taiga in the Highlands of [Scotland](https://www.britannica.com/place/Scotland). The areas of lowland central [Alaska](https://www.britannica.com/place/Alaska), the central [Yukon](https://www.britannica.com/place/Yukon-territory) territory, and the Far East region of Russia, which had climates too arid to permit the formation of ice sheets, were connected by the [Bering Land Bridge](https://www.britannica.com/place/Beringia), across which many species migrated. As a result, today across Alaska a gradient in plant characteristics can be observed, ranging from typical North American forms in the east to those with Eurasian characteristics in the west.

**Distribution**

The taiga regions of [North America](https://www.britannica.com/place/North-America) and Eurasia are broad belts of vegetation that span their respective continents from Atlantic to Pacific coasts. In North America the taiga occupies much of [Canada](https://www.britannica.com/place/Canada) and [Alaska](https://www.britannica.com/place/Alaska). Although related transition forest types are present in the northern tier of the lower 48 [United States](https://www.britannica.com/place/United-States), true taiga stops just north of the southern Canadian border. The vast taiga of Asia extends across [Russia](https://www.britannica.com/place/Russia) and southward into northeastern [China](https://www.britannica.com/place/China) and [Mongolia](https://www.britannica.com/place/Mongolia). In Europe most of [Finland](https://www.britannica.com/place/Finland), [Sweden](https://www.britannica.com/place/Sweden), and [Norway](https://www.britannica.com/place/Norway) are covered with taiga. A small, isolated area of boreal forest in the [Scottish Highlands](https://www.britannica.com/place/Highlands-region-Scotland) lacks some continental species but does contain the most widespread conifer of the Eurasian taiga, [Scotch pine](https://www.britannica.com/plant/Scots-pine) (*Pinus sylvestris*).

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**boreal forests: Eastern Hemisphere**

Distribution of boreal forests in the Eastern Hemisphere.

*Encyclopædia Britannica, Inc.*

**boreal forest: Western Hemisphere**

Distribution of boreal forests in the Western Hemisphere.

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The position of the taiga generally is controlled by the degree of warmth experienced during the [growing season](https://www.britannica.com/topic/growing-season), the temperature of the [soil](https://www.britannica.com/science/soil), and the extreme minimum winter temperature. The taiga biome consists of three roughly parallel zones: [closed-canopy forest](https://www.britannica.com/science/closed-canopy-forest), [lichen woodland](https://www.britannica.com/science/lichen-woodland) or sparse taiga, and forest-tundra. The closed-canopy forest is the southernmost portion of the taiga. It contains the greatest richness of species, the warmest soils, the highest productivity, and the longest growing season within the boreal zone. North of the closed-canopy forest is the [lichen](https://www.britannica.com/science/lichen) woodland—a smaller parallel zone of sparse forest or woodland in which tree crowns do not form a closed canopy. Lichen mats and tundralike vegetation make up a significant portion of the ground cover. To the north of the lichen woodland lies forest-tundra, which occurs along the northern edge of tree growth (tree line). Patches of trees consisting of only a few species dot restricted portions of the landscape, forming a complex mosaic with tundra. Many trees in the forest-tundra zone have never been known to produce viable seeds or have done so only sporadically. These trees were established during warmer climatic episodes from a few hundred to a few thousand years ago and have persisted since, usually by vegetative (asexual) [reproduction](https://www.britannica.com/science/reproduction-biology). Forest fires in this zone remove trees, and, because of the lack of reproduction, only unburned patches of trees remain.

The closed-canopy forest, or southern taiga zone, on both continents is not distributed along a strictly east-west axis. At the western margin of Europe, the warming influence of the [Gulf Stream](https://www.britannica.com/place/Gulf-Stream) allows the closed-canopy forest to grow at its northernmost location, generally between about 60° and 70° N. In western North America the [Kuroshio](https://www.britannica.com/place/Kuroshio) and North Pacific currents likewise warm the climate and cause the northward deflection of the forest into Alaska and [Yukon](https://www.britannica.com/place/Yukon-territory) in Canada. On the eastern margin of the continents, the taiga is deflected southward to between about 50° and 60° N by the cold polar air masses that flow south along these coasts. This is the southernmost limit of the taiga, to the south of which, in humid eastern North America and Europe, lies a northern deciduous broad-leaved transition forest. In this forest small stands of boreal conifers are distributed on cooler or less-productive sites such as [peaty](https://www.britannica.com/technology/peat) [wetlands](https://www.britannica.com/science/wetland). In the arid centre of both continents, the closed-canopy boreal forest is bordered to the south by a forest parkland of trees and [grassland](https://www.britannica.com/science/grassland).

The central portions of Eurasia and North America are regions of flat or gently rolling [topography](https://www.merriam-webster.com/dictionary/topography). There, the northern and southern boundaries of the taiga are broad and gradual; they have fluctuated by as much as 200 km (125 miles) during the past few thousand years. A well-defined but complex boundary is formed between taiga and alpine tundra on the mountains of the Pacific edge in western North America and the Far East region of Russia. Generally, the taiga does not come into contact with the humid temperate or subpolar rainforest of coastal Alaska and [British Columbia](https://www.britannica.com/place/British-Columbia) because of high mountain barriers, but some low-elevation regions have a transition zone often characterized by trees that are a hybrid of Sitka spruce (Picea sitchensis) and white spruce (P. glauca). In Norway and Scotland a variant form of the taiga occupies extremely humid environments.

Practically all the large [river](https://www.britannica.com/science/river) systems of the taiga of Siberia, including the [Ob](https://www.britannica.com/place/Ob-River), [Yenisey](https://www.britannica.com/place/Yenisey-River), and Lena rivers, are northward-flowing. The Ob in western Siberia forms a great lowland basin with a considerable percentage of the land surface covered with poorly drained peaty [wetlands](https://www.britannica.com/science/wetland). In such situations within the taiga a closed-canopy forest is generally absent.

# Environmental Conditions

## [Climate](https://www.britannica.com/science/climate-meteorology)

Coldness is the dominant climatic factor in taiga ecosystems, although a surprising [diversity](https://www.merriam-webster.com/dictionary/diversity) of climates exists. Several factors—namely, the solar elevation angle, day length, and [snow](https://www.britannica.com/science/snow-weather) cover—conspire to produce this cold climate. In the taiga [biome](https://www.britannica.com/science/biome) the [Sun](https://www.britannica.com/place/Sun) is never directly overhead (90°) as it can be in the tropics. The maximum solar angle decreases with increasing latitude. At latitude 50° N in the southern part of the taiga biome the maximum solar angle is 63.5°, and at the [Arctic Circle](https://www.britannica.com/place/Arctic-Circle) it is only 47°. As a result, [solar energy](https://www.britannica.com/science/solar-energy) is less intense in the taiga biome because it is spread out over a greater area of [Earth’s](https://www.britannica.com/place/Earth) surface than it is in equatorial regions. Day length also affects temperature. Long winter nights at high latitudes allow radiation emitted by the surface of Earth to escape into the atmosphere, especially in continental interiors where cloud cover is less abundant than it is near the coast. Snow cover too affects the climate, because it reflects incoming [solar radiation](https://www.britannica.com/science/solar-radiation) and amplifies cooling. During winter a snowpack persists for at least five months in the southern portion of the taiga biome and for seven or eight months in the northern reaches. The taiga actually [mitigates](https://www.merriam-webster.com/dictionary/mitigates) this cooling because it roughens and darkens what would otherwise be a smooth, snow-covered, energy-reflecting surface for much of the year. It has been estimated that Earth would be significantly colder without the taiga.

he northern limit of the North American taiga coincides with the mean position of the Arctic front—the boundary between Arctic and mid-continental air masses—in the summer; its southern limit coincides with the mean frontal position in the winter. Mean annual temperatures in the taiga range from a few degrees Celsius above freezing to −10 °C (14 °F) or more. Areas with a mean annual temperature below freezing are susceptible to the formation of [permafrost](https://www.britannica.com/science/permafrost) soils (frozen ground; see below [Soils](https://www.britannica.com/science/taiga/Environmental-conditions#ref70834)).

The mean temperature of January, the coldest month, is generally less than −10 °C (14 °F) across the taiga. The taiga includes areas that experience some of the lowest temperatures on Earth, excluding Antarctica. At the height of winter an intensely cold pocket of air develops over inland areas of far eastern Siberia; mean temperatures of −50 °C (−58 °F) have been recorded in this region. As this Siberian cold air flows over the unfrozen northern [Pacific Ocean](https://www.britannica.com/place/Pacific-Ocean), a great temperature contrast develops that results in strong, westward-moving storm systems. The movement, position, and strength of these storms control much of the weather in the Northern Hemisphere.

Boreal forests do not grow on areas surrounding the [Bering Strait](https://www.britannica.com/place/Bering-Strait). A rigorous cold climate with a very short snow-free season precludes the growth of trees on the Russian side of the Bering Strait in the Chukotka region of the Russian Far East. On the North American side, in western [Alaska](https://www.britannica.com/place/Alaska), summers are too cool for trees to grow, because of cold air masses moving off the [Bering Sea](https://www.britannica.com/place/Bering-Sea).

The [growing season](https://www.britannica.com/topic/growing-season) in the taiga is generally cool. The mean temperature of the warmest month, July, is generally between 15 and 20 °C (59 and 68 °F). Summer daytime high temperatures are typically cool to warm—20 to 25 °C (68 to 77 °F)—for much of the growing season in the taiga. Cool summer temperatures can actually produce higher photosynthetic [efficiency](https://www.merriam-webster.com/dictionary/efficiency) in plants than can warmer conditions. Species adapted to cold respire less (use up less of their food stores) when photosynthesizing at cool temperatures in intense summer light than they do at higher temperatures, allowing a greater net gain in biomass (dry mass of organic matter).

Areas of the taiga located in the centre of continents generally receive 30 to 50 cm (12 to 20 inches) of annual precipitation. Precipitation totals are relatively modest in these locations because they are a significant distance from unfrozen oceans that supply moisture. Some taiga regions are semiarid and may even include grasslands interspersed with the [forest](https://www.britannica.com/science/forest). These forests are found in regions of Yukon and Alaska that occur on the leeward side of mountains which are sheltered from moisture-bearing winds, as well as in some portions of the interior of the Far East region of [Russia](https://www.britannica.com/place/Soviet-Union). Annual precipitation in low elevations of these regions is 30 cm or less. The highest annual precipitation total in the taiga, which can exceed 100 cm, is in eastern [North America](https://www.britannica.com/place/North-America) and northern Europe. During ancient eras of colder climate, these regions also received relatively abundant precipitation, which resulted in the buildup of glacial ice sheets. Today these once heavily glaciated regions support extensive [lakes](https://www.britannica.com/science/lake), streams, and wetlands.

Extended periods of clear, dry weather in the boreal region are caused by persistent strong polar high pressure systems. If strong high pressure persists during the long days near the [summer solstice](https://www.britannica.com/science/summer-solstice-astronomy), temperatures can warm to 30 °C (86 °F) or higher. Intense heating at the ground surface often produces convective storms with lightning but little [rain](https://www.britannica.com/science/rain), causing forest fires.

## [Soils](https://www.britannica.com/science/soil)

Taiga [conifer](https://www.britannica.com/plant/conifer) litter is highly acidic. Soils of the more humid and southern taiga are highly leached [spodosols](https://www.britannica.com/science/Spodosol), which are characterized by the leaching of iron, aluminum, and organic matter from the chemically and biologically distinct surface layer—horizon A—to the next layer—horizon B. Much of the [soil](https://www.britannica.com/science/soil) of central and eastern Canada—granitic Canadian Shield—has been repeatedly scraped clean by glacial advances. Thus, productive forests often are restricted to portions of the landscape where soil material has been deposited by glaciers. Peaty wetlands occur where surface drainage is impeded by permafrost, youthful glacial [topography](https://www.merriam-webster.com/dictionary/topography), or aggraded rivers; their soils are characteristically organic soils, or [histosols](https://www.britannica.com/science/Histosol-soil). Soils in much of boreal western North America and [Asia](https://www.britannica.com/place/Asia) are [inceptisols](https://www.britannica.com/science/Inceptisol), which have little horizon development. Very thin surface salt deposits are found in the most arid portions of the taiga.

Cold soils are characteristic of taiga regions, which overlaps the zone of [permafrost](https://www.britannica.com/science/permafrost). Permafrost is soil or earth material that remains below 0 °C (32 °F) for at least two years. The surface, or active, layer of permafrost thaws in the warm season and freezes in the winter, but the soil below the active layer remains continuously frozen. Because the plant rooting zone is restricted to the active layer, [nutrient](https://www.britannica.com/science/nutrient) supply is limited and secure anchoring for roots is lacking. Some trees and other plants of the taiga (especially black [spruce](https://www.britannica.com/plant/spruce) [Picea mariana] and tamarack [Larix laricina] in North America and larches in Siberia) can grow on permafrost if the active layer is sufficiently deep, but several [species](https://www.britannica.com/science/species-taxon) are eliminated from permafrost.

The taiga itself is an important contributing factor to the development of permafrost. The latter stages of forest growth—characterized by development of an intact forest canopy, growth of an insulating [moss](https://www.britannica.com/plant/moss-plant) cover in summer, and accumulation of forest litter—may cool the soil to such an extent that permafrost develops. Warming of the soil is promoted by forest fires, which remove the canopy, moss, and forest litter layers. In the absence of an intact canopy, a deeper and more effective insulating layer of snow accumulates in the winter. The presence of dark ash following a fire increases solar energy absorption on the site for several years.

The taiga of Europe generally lacks permafrost, but east of the [Ural Mountains](https://www.britannica.com/place/Ural-Mountains) and from central [Canada](https://www.britannica.com/place/Canada) northward permafrost is common. In southern and central parts of the taiga, permafrost occurs sporadically and occupies only a small percentage of the landscape that experiences the coldest temperatures. The northern portion of closed-canopy forest and the [lichen](https://www.britannica.com/science/lichen) woodland zone are in a region of discontinuous permafrost, where permafrost is found on north-facing slopes and in cold air drainage basins but is absent from south-facing slopes and newly deposited alluvial sites. Most of the forest-tundra is within the continuous permafrost zone.

Forest productivity in the middle and northern taiga zones is directly related to soil temperature. Warmer soils decompose organic matter more quickly, releasing nutrients for new plant growth and creating a more productive site. Productive forest types occupy warmer, south-facing slopes and river terraces, and less productive dwarf or sparse forest occupies the north-facing and basin permafrost sites.

[Floodplains](https://www.britannica.com/science/floodplain) throughout the taiga biome are free of permafrost, high in soil fertility, and repeatedly disturbed in ways that renew the early, rapid growth stages of forest succession. Floodplains are a mosaic of productive [shrubland](https://www.britannica.com/science/scrubland) and forest that serve as a major [habitat](https://www.britannica.com/science/habitat-biology) for [moose](https://www.britannica.com/animal/moose-mammal) (Alces alces), which influence [ecosystem](https://www.britannica.com/science/ecosystem) structure and function.

South-central Alaska and [adjacent](https://www.merriam-webster.com/dictionary/adjacent) Yukon and [British Columbia](https://www.britannica.com/place/British-Columbia) support the most extensive ice sheets and [glaciers](https://www.britannica.com/science/glacier) in the world outside the polar [desert](https://www.britannica.com/science/desert) regions of Antarctica and Greenland. [Glacial](https://www.britannica.com/science/glaciation) meltwater is a large part of the flow of larger rivers such as the [Yukon](https://www.britannica.com/place/Yukon-River) and [Tanana](https://www.britannica.com/place/Tanana-River) in Alaska and the Yukon territory. [Glacial meltwater](https://www.britannica.com/science/outwash) carries a heavy load of suspended sediment that deposits in riverbeds and causes frequent channel shifts. Glacial river floodplains are extensive, very [dynamic](https://www.merriam-webster.com/dictionary/dynamic), and constantly renewed with fertile soil material. In the ancient past exposed deposits of glacial silt were picked up by strong winds and deposited on surrounding hillsides. Fertile soils, known as [loess](https://www.britannica.com/science/loess), resulted, on which highly productive upland forests are found today. Because the beds of glacially fed rivers are rising, the landscape through which they flow is partially drowned from the impeded drainage, often preventing forest growth and favouring the development of marshes and mires.