



# Roadside TRAIL

## An Environment of Extremes

The boreal forest of Denali is a subarctic ecosystem consisting of a patchwork of coniferous and deciduous tree stands interspersed with lakes, wetlands, and tundra. Boreal forests support relatively few plant species, mainly white and black spruce and a small number of deciduous trees and shrubs. Boreal forests in Denali are underlain by discontinuous permafrost, inorganic soils that are frozen for all or most of the year. Summers are short, wet, and moderately warm, while winters are long, extremely cold, and dry. Explore the boreal forest and discover the strategies that plants use to survive the extremes of the subarctic environment.

## LONG DAY Short Summer

When the tilt of the Earth's axis orients the northern hemisphere toward the sun, days are long, with almost 24 hours of daylight peaking in mid-June.

## Fast and Expensive

Deciduous trees and shrubs, like aspen, birch and willow, put their energy into producing new leaves annually. Their large leaves photosynthesize throughout the long daylight hours, fueling rapid growth. Aspen also produce chlorophyll in their bark, allowing the tree to begin photosynthesizing before leaves have emerged.

## Slow and Frugal

Conifers such as black and white spruce put their energy into producing needles that will stay on the tree for multiple seasons. This requires a larger investment upfront and slows overall growth, but allows the tree to photosynthesize whenever temperatures allow.

### White Spruce

*Picea glauca*  
Evergreen

Leaves: 1-2.5 cm long, 4 sided.

Bark: Loose ashy brown scales.

Average Height: 20-65 ft (7-20 m).



### Alaska Paper Birch

*Betula papyrifera nealaskana*  
Deciduous

Leaves: Egg to diamond shaped, sharp pointed, edges finely double-toothed. 4 - 8.5 cm long.

Bark: White to yellowish copper brown, peels in papery strips.

Average Height: Up to 49 ft (50 m).



### Photosynthesis

Almost all life on Earth depends on food produced by organisms that photosynthesize. Photosynthesis is the process by which plants harness the sun's energy to create carbohydrates that fuel growth. The green pigment, chlorophyll, visible in leaves and in the bark of aspen, absorbs the energy from sunlight. This triggers the chemical reaction that produces sugars and starches used by the plant to grow. Oxygen is released into the atmosphere as a by-product of this reaction.

# SHORT DAY

## Long Winter

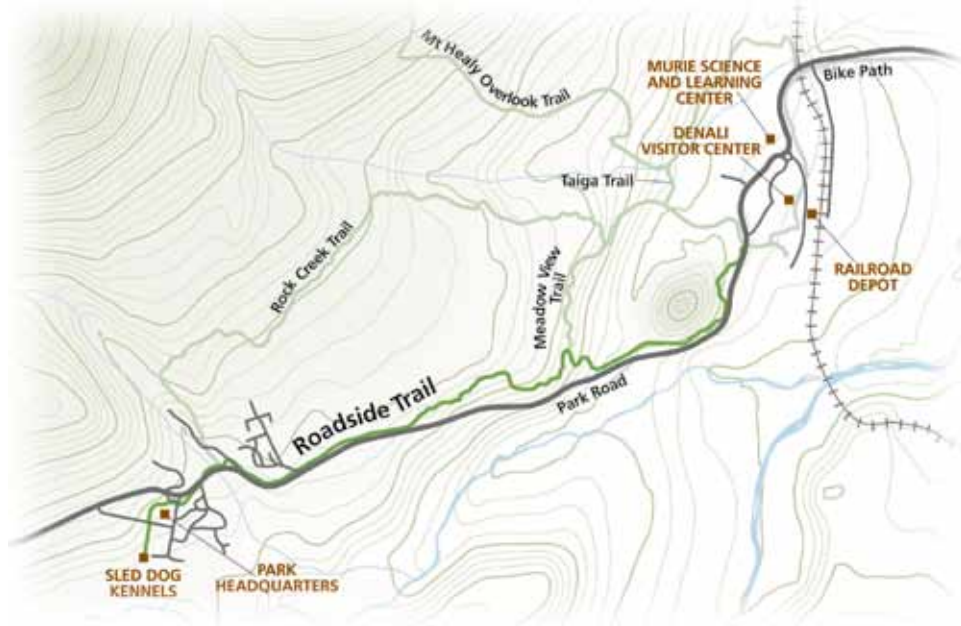
When the northern hemisphere noticeably tilts away from the sun days are short. The sun barely crests the horizon, and winter temperatures can stay well below zero for sustained periods.

### Warm Above, Cold Below

Along the trail, you will find open boggy areas with a few, spindly trees. This could be evidence of permafrost, which prevents rain and runoff from penetrating into the soil. During the summer an insulating layer of moss keeps the permafrost cool.

### Cold Above, Warm Below

Low-growing herbaceous plants, such as low-bush cranberries, lingonberries and crowberries, benefit from being covered by snow in the wintertime. While the temperature above the snow can be  $-40^{\circ}\text{F}$ , the temperature beneath the snow can be much warmer, even close to the freezing point at  $32^{\circ}\text{F}$ , because the layer of snow acts like an insulating blanket.

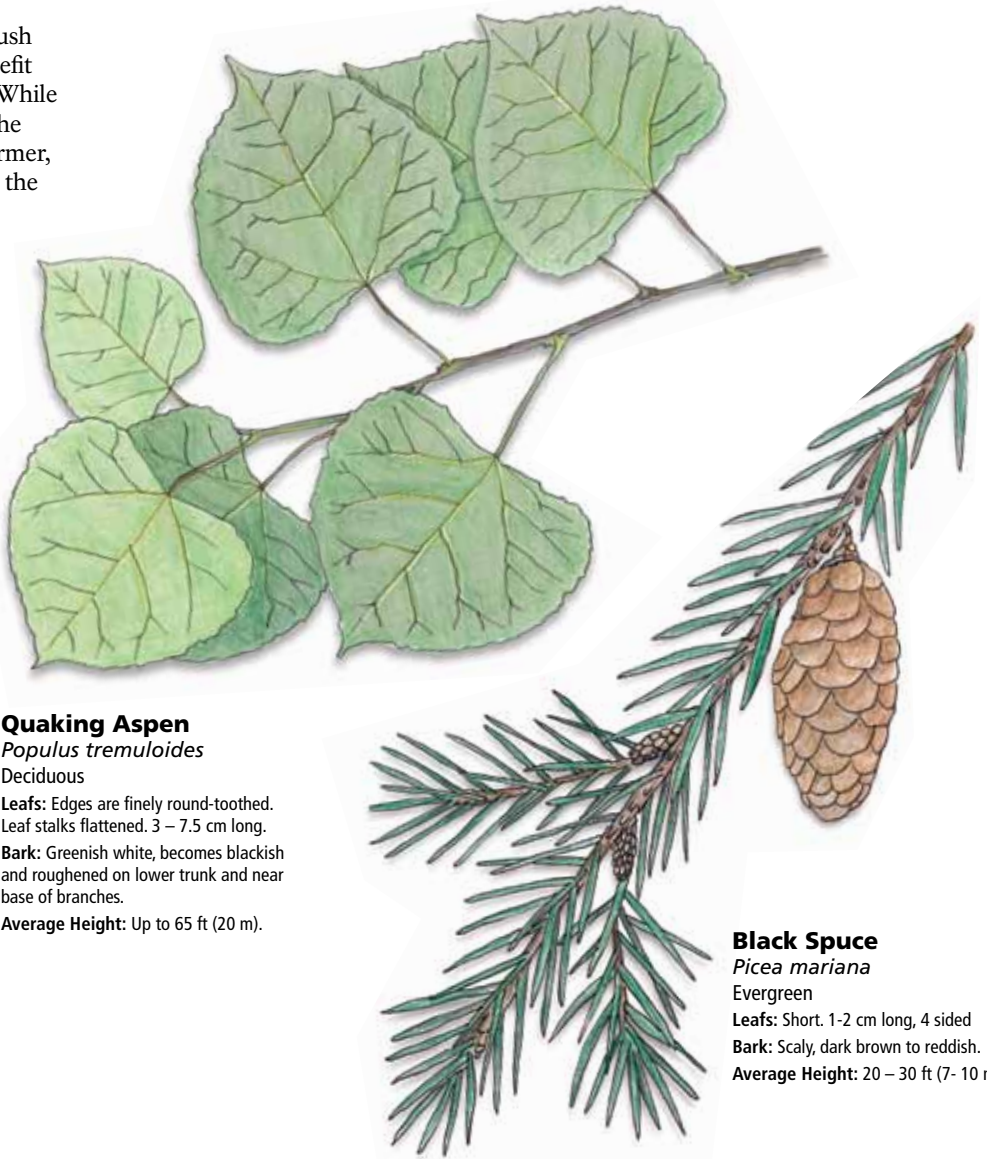


### Cold Hardening

Trees of the boreal forest undergo a unique change in order to survive winter. In the fall, a series of chemical signals, triggered by shortening day lengths, stops the growth process. At this time, water inside the cells is transported outside of the cells, leaving behind a sticky fluid of concentrated carbohydrates that has a lower freezing temperature than water. This "hardening" process allows plants to tolerate cold temperatures without their cells rupturing due to the water inside expanding when it freezes.

### Heavy Load

Spruce trees are structurally different from deciduous trees. Spruce branches grow downward instead of upward like deciduous trees. Snow pushes spruce branches down until the snow sloughs off, allowing the branches to spring up to their former position. An entire hillside on the trail features bent-over aspen and birch, reminders of a snowstorm in September 1993. Still with leaves, the trees caught the falling snow, which accumulated until they bent over due to the weight.



### Quaking Aspen

*Populus tremuloides*

Deciduous

**Leaves:** Edges are finely round-toothed. Leaf stalks flattened. 3 – 7.5 cm long.

**Bark:** Greenish white, becomes blackish and roughened on lower trunk and near base of branches.

**Average Height:** Up to 65 ft (20 m).

### Black Spruce

*Picea mariana*

Evergreen

**Leaves:** Short. 1-2 cm long, 4 sided

**Bark:** Scaly, dark brown to reddish.

**Average Height:** 20 – 30 ft (7- 10 m).



Denali Trails | Roadside Trail  
Moderately strenuous  
1.8 miles/2.9 km, 1 hr one way  
Please stay on trails.

This trail guide was produced in partnership by the National Park Service and the Alaska Geographic Association.

