

# Denali National Park and... Climate Change

## Massif "Denali" ... "Great One,"

--coined and translated by the indigenous Athabascan people

### **Introductory Remarks:**

Much of Alaska's environment exists near the melting point of ice (-2 degrees Celsius). Therefore, even the slightest projection of a warmer climate has serious implications for Alaska's fragile ecosystem. Denali National Park in particular has suffered significant changes in recent years and will likely continue to do so under a warmer climate. The following fact sheet discusses the major sectors of impact threatening the well-being of Denali.

### **Biome Shift**

- Both current evidence shows and model projections indicate that the tundra biome will slowly give way to taiga under warming conditions.
- Denali tundra is now blooming slightly earlier due to drier summers and heavier winter snowfalls; while the snow is melting from tundra a month earlier than usual.
- Tundra is slowly becoming brushier and giving way to forests
- Seasonal changes may result in widespread loss of habitat diversity and changes in faunal distribution.
- Species at risk include several of Denali's main attractions, including caribou, moose, black/brown bears, wolves, and Dall Sheep.
- In particular, caribou are sensitive to changes in weather and vegetation because they give birth at specific times and locations.

### **Forests**

- Current research indicates that the regional tree line is moving farther north and will continue to do so under increasingly warmer future predictions.
- Experiments conducted in Denali indicate that warming will promote growth of birch at the expense of sedges, forbs, and other plants that caribou and other wildlife favor as food sources. Birch growth alters the ecology of tundra by covering moss with larger amounts of leaf litter.



The new growth of black spruce on a hillside in Denali National Park Headquarters. Botanist Glenn Juday has found that forest cover has advanced in elevation over the last century. This is consistent with the hypothesis that forest area is positively correlated to increased temperatures and carbon dioxide levels.

### **Forests cont.**

- Forest fires in Denali will likely increase due to excessive drying of wood and landscape, as well as an increase in extreme weather/lightning events.
- A proliferation of insects has besieged spruce forests in Denali, particularly of the dark spruce beetle due to an extension of warmer months and faster maturation of insects.

## Suggested Reading

**World View of Global Warming** ([www.worldviewofglobalwarming.org](http://www.worldviewofglobalwarming.org))

**National Parks Conservation Association** ([www.npca.org](http://www.npca.org))

**Center for Global Change** ([www.cgc.uaf.edu](http://www.cgc.uaf.edu))

**Howling at a Waning Moon:** *Tracking the Bush administration's assault on the environment, our health, and our children's quality of life*

([http://bobwhitson.typepad.com/howling/2004/10/national\\_parks\\_.html](http://bobwhitson.typepad.com/howling/2004/10/national_parks_.html))

**Denali National Park:** *Introduction and General Information* ([www.denalinationalpark.com](http://www.denalinationalpark.com))



### Permafrost

- Permafrost temperature in Denali has increased 0.5-1.5 degrees Celsius since 1980, which has caused forest damage, the sinking of roads and buildings, and the eroding of tundra riverbanks.
- Furthermore, permafrost melting has changed the tundra vegetation because the amount of time for tundra plants to interact with greenhouse gases has been extended. This alters the timing of when forage plants are available for grazing animals.
- The melting permafrost has become a source of carbon dioxide, emitting an amount of carbon equivalent to eight percent of human emissions per year.
- Methane output, which forms from the decomposition and roots of active plants, has increased by the tundra. This is likely due to the lengthening snow-free period throughout the arctic.

### Glacial Melting

- Glaciers in Denali and throughout the Alaskan region are retreating, thinning, stagnating, or a combination of all three.
- Current evidence estimates a reduction in general ice-thickness by ten meters.
- Future projections surmise that a sustained warming of one degree Celsius will reduce glacier lengths by fifteen percent throughout Denali and other parts of Alaska.
- Determining the role of human vs. natural-induced warming is a complex issue in Alaska because some of Alaska's glaciers began their retreat more than 250 years ago, before the great expansion of human population and carbon dioxide emission.
- Other Alaskan glaciers began their massive retreat in the last 25 years, so pinpointing blame is difficult in the scientific community.

By Katie Edwards, in conjunction with  
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Geophysicist Tom Osterkamp indicates ground level when he installs this temperature probe in Denali's tundra region. In 15 years, Alaskan permafrost temperature has increased 0.5° to 1.5° C.

### Feedback Loops

- Climatic warming could change the amount of albedo in Denali. Proposed roads through Denali could create soot build-ups from diesel engines that fall on snow. These darkened snow surfaces would then have a lower reflection capacity.
- The future role of Denali's forests as sources or as sinks is largely contested. An increase in tree growth due to a warmer climate could increase the amount of carbon sequestration from the atmosphere. However, an increase in forest fire frequency would release large amounts of previously-stored carbon into the atmosphere.
- The loss of sea ice in the region is projected to increase precipitation and river flow over parts of the arctic, resulting in fresher oceans. However, the darker open water has a lower albedo.
- As the snow cover on the tundra becomes more discontinuous, its albedo will go down, creating a positive feedback for global warming.