CLIMATE CHANGE: Alaska's National Wildlife Refuges
Kenai National Wildlife Refuge

Climate and Ecology: The Kenai Peninsula is influenced by both maritime and continental climate patterns. Under the Köeppen climate classification system, which delineates climatic zones based on a combination of native vegetation, average annual and monthly temperatures and precipitation, and the seasonality of precipitation, the Kenai National Wildlife Refuge is included in the Continental Subarctic Climate zone[1]. This climate zone is characterized by an average temperature above 50 °F (10 °C) in the warmest months, and a coldest month average below 32 °F (0° C) [2]. Two-thirds of the Kenai NWR is located on the Kenai Lowlands, which receives an average of 17 – 19 inches (43 - 48 cm) precipitation each year, including 55 inches (140 cm) of snow.

Mean temperatures in south-central Alaska have warmed at a rate of 3°F per century during the 20th Century[4]. Climate data for the Kenai Lowlands reveal both an increase in summer temperature of 1.9° F (1.1 °C) and a 55% decrease in water balance (to 6.6 cm) over the past 40 years[5]. Meteorological stations at Kenai and Homer document mean annual temperature increases of 3.5°F (2.0°C) and 3.9°F (2.2°C), respectively, since 1944. Much of these increases can be attributed to warmer Decembers and Januarys. Annual precipitation varies considerably on the Kenai Peninsula; however, neither station indicates a long-term change in precipitation values[6].

The western side of the Kenai Peninsula is characterized by low lying marshy terrain, with abundant small lakes, several large lakes, and many rivers supporting both anadromous and fresh water fish populations. Published and anecdotal evidence that appears to corroborate warming trends indicated by weather data on the Kenai Peninsula includes: rising tree lines in the Kenai Mountains, drying muskegs, kettle ponds, and closed basin lakes, rapid glacial retreat, invasion of wetlands by woody vegetation, drought stressed trees, and prolonged spruce bark beetle outbreaks.

There are approximately 5,000 moose occur on the refuge that feed on submerged aquatic vegetation in wetlands and shallow lakes in the summer and on young birch, aspen and willow in the winter. Analysis of historical aerial photos between 1950 and 1996 indicate increased forest cover and decreased open and wet areas. During the same period, water levels in closed-basin lakes declined by as much as 1 meter, and many wetlands have been invaded by black spruce and hardwood shrubs[5]. Increasingly frequent runs of warm summers have allowed spruce bark beetle populations to grow exponentially; during the warmest summers the normal two-year beetle life cycle contracts to one year, yielding double doses of beetles. In addition, warmer winters have facilitated greater overwinter survival of larvae and adult beetles. As a result, by 2000 the beetles had killed virtually all mature white/Lutz/Sitka spruce trees on the western Kenai. At that time this was the largest bark beetle outbreak recorded in North America.

The intersection of a warmer, drier climate with a fuel-rich landscape will likely lead to more intense and more frequent wildfires in the black and white spruce forests. While moose may benefit from greater availability of post-fire browse in the short-term, relatively fire-resistant mature hardwoods may become the prevalent forest type on the landscape as fires burn more completely and frequently. This, together with invasion of wetlands by woody shrubs and black spruce may lead to a reduced moose population on the Kenai.

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The Kenai River is considered Alaska's most popular sportfishing river, and sustains one of the State's most valuable salmon fisheries[7]. In order that fry emergence occur at the most favorable time of the year, each species of Pacific salmon has adapted to spawn at specific times and at physiologically optimum water temperatures. Fish living in freshwater at mid- to high latitudes and cold-water fish near the southern limits of their range are predicted to be most affected by climate warming[10]. Depending on the species, changes in water temperature can have either favorable or detrimental effects on fish growth, egg development, transition from freshwater to saltwater, migration, spawning, incidence of disease, and competition and predation[7]. Simulation of future water-temperature trends using available data suggests that potential warming depends on watershed characteristics, and predicts a 3°C (5.5°F) increase in streams and rivers without significant glacial input and those draining lowlands[7]. A temperature increase of this magnitude may increase the incidence of disease in fish[7].

Hunting and fishing are important to the local economy on the Kenai Peninsula where about 70 to 80% of households use locally-harvested resources[9]. In the long term, projected ecosystem shifts and range contractions may displace or change resources available for this harvest.

Conservation and Management: In May 2008, Kenai NWR staff released for public review the Draft Revised Comprehensive Conservation Plan and Environmental Impact Statement. The final version of the Comprehensive Conservation Plan will guide management of the Refuge for the next 15 years, outlining management actions that will enable refuge managers to understand, anticipate, and respond to climate change-related impacts on trust resources with the goal of ensuring natural diversity and viability of species, habitats, and ecosystems into the future.

Related Links:

Observations of Climate Change on the Kenai Peninsula, 1999
Ancient bent trees at treeline are straightening up, tell of climate change
Field Guide: Kenai Peninsula Pond and Lake Levels
Wetland drying and succession across the Kenai Peninsula Lowlands, south-central Alaska
Fire and Climate History of Lowland Black Spruce Forests, Kenai National Wildlife Refuge Alaska
The History of Spruce Bark Beetle Outbreaks in the Kluane Region as Determined from the Dendrochronolgy of Selected Forest Stands
Studies in the Wilderness Areas of the Kenai National Wildlife Refuge: Fire, Bark Beetles, Human Development, and Climate Change
Rapid Wastage of Alaska Glaciers and Their Contribution to Rising Sea Level
Draft Revised Comprehensive Conservation Plan and Environmental Impact Statement
Water Temperature of Streams in the Cook Inlet Basin, Alaska, and Implications of Climate Change
Landscape drying, spruce bark beetles and fire regimes on the Kenai Peninsula, Alaska

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Sources:

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