



Fire History and Climate Change

Question: What can fire activity and vegetation changes in Rocky Mountain National Park during the last 7,000 years tell us about its climate history?

The increase in fire frequency and acres burned in Colorado over the last three decades has been attributed in part to an increase in mean annual temperature. To study the relationship between fire frequency and climate over a longer period of time, Maria Caffrey (University of Tennessee) and James Doerner (University of Northern Colorado) used a sediment core taken from the floor of Bear Lake in 2006.

Project: Analyze charcoal and pollen samples for evidence of the park's fire, vegetation, and climate history.

The 257-cm (101-in) sediment core spanned 7,000 years before present (BP). Charcoal in the core serves as an indicator of fire frequency, and the pollen was used to identify plant species and abundance, from which climate conditions could be inferred. The subalpine forests surrounding the lake are currently dominated by spruce (*Picea engelmannii*) and lodgepole pine (*Pinus contorta*).



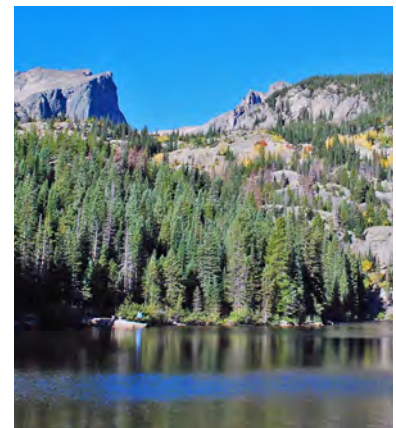
Core sampling at Bear Lake.

Results: Climate change has had a significant impact on the area's vegetation and the frequency and intensity of fire.

Based on pollen data, the core was divided into four time periods with inferences about climate.

- 7000–3500 BP: tree pollen was more dominant than at present, indicating the proliferation of a dense spruce-pine forest and temperatures increasing to warmer than present. A dry climate prevailed until 5000 BP, when a decrease in pine pollen and the ratio of spruce to *Artemisia* (sagebrush) suggests that one or more fires burned around Bear Lake. Based on counts of charcoal particles, mean fire frequency peaked at 5.3 per 1,000 years at 5070 BP.
- 3500–1700 BP: the overall pollen accumulation rate decreased, especially for spruce, while sagebrush continued to increase, indicating a more open forest and a cooler climate than at present. Charcoal samples suggest that fire frequency reached a low of 2.8 per 1,000 years in 3540.
- 1700–850 BP: Non-arboreal pollen, especially sagebrush and Ambrosia (ragweed) increased. Spruce pollen decreased after a charcoal peak at about 1150 BP, indicating a stand-replacing fire, and fire frequency increased to 3.7 per 1,000 years by about 870 BP. Temperatures began to warm.
- 850 BP to present: tree species rebound. A peak in charcoal coupled with an increase in pine and a decrease in spruce around 110 BP may reflect warming temperatures. Several large fires occurred near Bear Lake at about this time. However, fire activity declined when the park was established in 1915 and fire suppression efforts began.

Factors other than climate change may have been responsible for the pollen and charcoal data derived from the sediment core analysis, but the implications regarding climate are generally consistent with climate reconstructions done in and around the park using other methods. The results support the likelihood of increased fire activity under current projections of warmer summer temperatures.



Bear Lake today.