Monitoring Landscape Change in Lake Clark National Park Using Historical Photography

ABSTRACT

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A project was initiated in 2003 to assess landscape changes in the Southwest Area Network of National Parks through the use of repeat photography. As of the end of 2004, a total of 172 historical photographs have been acquired for Lake Clark National Park (LACL) dating back to 1895. The most abundant collections of photographs were those from Stephen Capps (85 from 1928 to 1929), Frank Moffit (20 from 1920), and Arthur Grantz (20 from 1950). During 28–30 July 2004, 52 of the photographs were repeated using a helicopter for access. Emphasis was placed on medium range (main subject at 50–500 m distance) subjects related to volcanism, glaciation, landslides and avalanches, coastal processes, floodplain dynamics, lake shorelines, tree and shrub expansion, and fire and plant succession.

A comparison of the historical and recent photographs indicate that many of these processes have created dynamic changes in the park. The Tanaina Glacier at Lake Clark Pass has retreated 1.4 km from 1940 to 1999, with most of the retreat occurring between 1954 and 1979. Mudflats along Chinitna Bay, which were uplifted by the 1964 earthquake, show extensive colonization by halophytic wet meadows as evident from photos from 1909. White spruce at treeline near Two Lakes and alder shrub near the Kijik River have made substantial upward expansions as evident from photos from 1928–29. Channel migration in glacial rivers indicate the floodplains continue to be active and dominated by barren gravel. In tundra areas above treeline, there appears to be little change in vegetation.

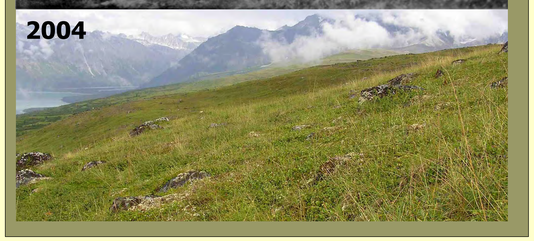
Coastal Dynamics After Uplift from the 1964 Earthquake

Effects of coastal uplift from the 1964 earthquake is evident from airphotos from 1954 and 1978 and a Ikonos image from 2004, and from ground photographs from 1921 (Frank Moffit) and 2004 (T. Jorgenson).

The ground photos of Seal Spit in Chinitna Bay show development of a lush coastal meadow dominated by *Carex lyngbyei* and the establishment of a few scattered Sitka spruce on the gravel spit.

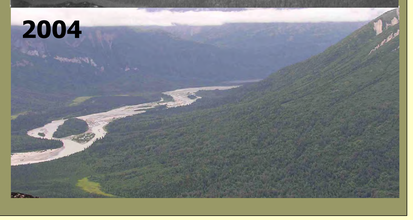
The airphotos and satellite images at the mouth of Little Glacier Creek show extensive development of salt meadows on the mudflats. Most of the change is evident from 1954 to 1978. On the higher, inactive mudflats many of the tidal ponds have drained by 2004. Little change is evident in the dendritic network of tidal guts on the inactive flats.

Tundra Vegetation Succession



Photographs from 1929 (Stephen Capps) and 2004 (Jorgenson) reveal little change in tundra vegetation on the morainal ridge over Lake Telaquana over the 76-year period. There is some evidence that dwarf birch has formed a denser ground cover and has obscured some of the rock, but there has been little change in height. No expansion of white spruce or alder are evident on the upper slopes at an elevation of 2800 feet.

River Channel Changes



Photographs from 1909 (Frank Katz) and 2004 (Jorgenson) reveal substantial channel migration on the floodplain of the Tlikakila River over a 95-year period. Note reconfiguration of the large island (foreground) and revegetation of the mid-channel bar. Behind the island, the left side of the floodplain has stabilized and become vegetated. Other large mid-channel bars also have become vegetated.

Glacial Retreat

Images from 1999 (NASA Landsat), 1979 (AHAP CIR), 1973 (M. Williams), 1954 (USGS), and 1940 (B. Park) reveal the Tanaina Glacier has retreated ~1.4 km over a 59-year period. Most of the retreat occurred between 1954 and 1979, with only minor retreat from 1979 to 1999, although the early faster retreat was probably related to the thinner ice at the glacier margin.

Treeline Expansion

Photographs from 1928 (Stephen Capps) and 2004 (MTJ) near Two Lakes shows the dramatic increase of young white spruce trees near treeline. The presence of white spruce on the lower slope (background) in 1928 indicates the tree expansion is most likely due to treeline moving upward instead of recovery from fire.

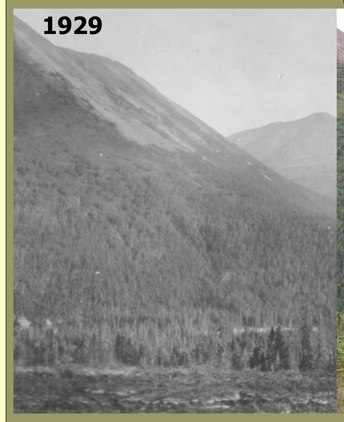
Recovery After Fire

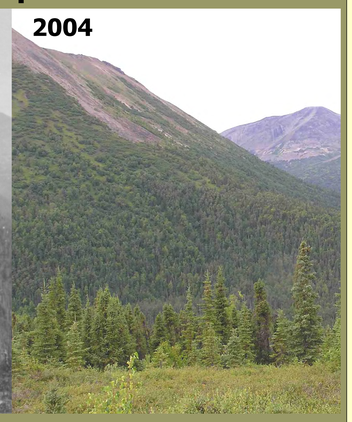
Photographs near Tanalien Falls from 1909 (Frank Katz) and 2004 (Jorgenson) reveal dramatic changes in vegetation from plant succession after a fire shortly before 1909. Scattered white spruce trees survived the fire and overtop the closed canopy of paper birches that are about 90 years old.

Shoreline Stability

Photographs by C.W. Purington during a cruise in Cook Inlet in 1895 provide the oldest collection of photographs for the parks. The 2004 photograph by Jorgenson reveals little change in the bedrock coastline and the persistence of alder shrub vegetation along the cliff.

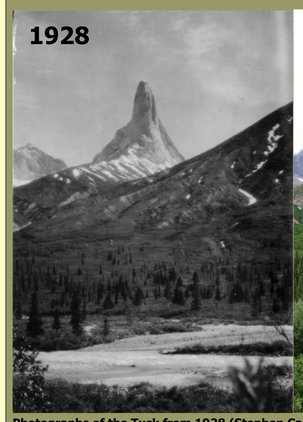
Alder Expansion

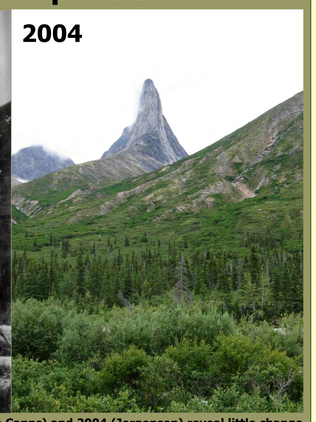




Photographs from 1929 (Stephen Capps) and 2004 (Jorgenson) of a mountains slope along the Kijik River showing the expansion of alder shrub in the subalpine. Lower on the slope white spruce trees have emerged from the canopy and now dominate the mixed spruce-birch forest.

Treeline Expansion





Photographs of the Tusk from 1928 (Stephen Capps) and 2004 (Jorgenson) reveal little change in treeline over the 76-year period. The trees near the creek have grown larger and denser, but there a few additional trees evident on the slope. In contrast, willows and cottonwood along the Another River have become much more prominent.