Climate Change in the Tahoe Basin

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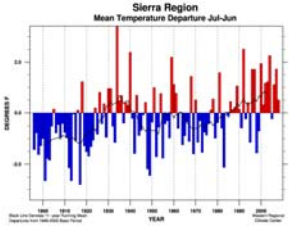
Addressing Science Needs in the Lake Tahoe Basin

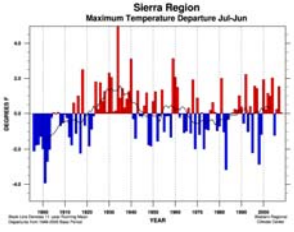
Regional Climatic Trends

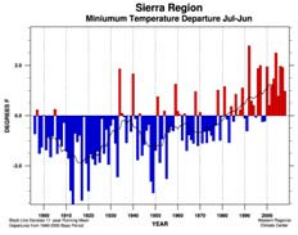
The mountains are the main source of water for California and Nevada. Climate conditions in the Sierra Nevada affect the amount and timing of snowpack accumulation and melt, and thus spring and summer streamflow and annual groundwater recharge. Climate conditions also affect fire, recreation, transportation, tourism, and ecological function.



Average 12-month temperature for July through June, (relative to the 1949-2005 mean) show a gradual increase, accentuated after about the mid-1970s. The 1930s (and 1933-34) were also warm. Black lines show 11-yr running means. Graphs current through June 2008. Source: NOAA Western Regional Climate Center**.** See interactive plots at:

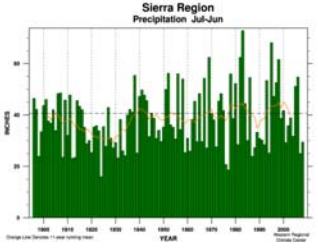
www.wrcc.dri.edu/monitor/cal-mon/index.html

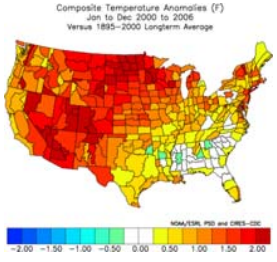




Daytime maximum temperatures (above, left) exhibit a history different from those of overnight minimum temperatures (above, right). This is a very common pattern seen around the western United States. Night temperatures may not be noticed by humans, but snow, plants and animals are affected by temperatures at all hours of the day.

Sierra winter precipitation shows large variability, but with little overall trend. Recent years have brought more multiple-year wet and dry episodes. Very wet winters, and major floods on the American River, are more common over the last 55 years.

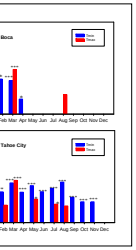




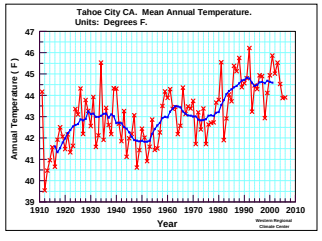
Most of the warming that is taking place in the United States is in the West. This trend started about 1975. The 7 years from 2000-2006 were particularly warm, and especially in summer. This asymmetric pattern may reflect uneven warming in the Pacific and Indian Oceans. For the past half century, the western Pacific and eastern Indian Ocean have warmed in a manner similar to the western US.

Local Climatic Trends

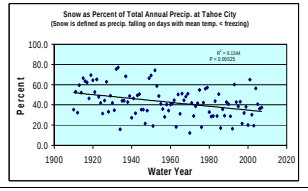
The graphs below show monthly temperature trends (1956-2005) at 4 stations in the Tahoe region. At Tahoe City, the warming at night is stronger than in the day, for most months, and in contrast with Boca, remains high through summer and fall. The high nighttime warming rate at Reno may reflect a residual effect of landscape irrigation. Asterisks indicate significance level.



As elsewhere in the Sierra, warmer temperatures at Tahoe are shifting precipitation from snow to rain at middle elevations. This shift will have negative consequences for the ski industry as well as for summer water supply.

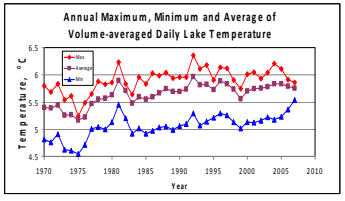


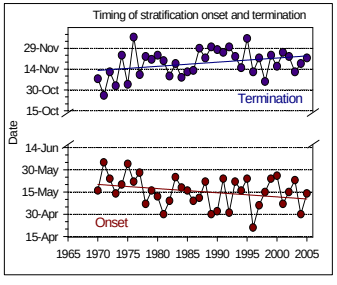
As temperatures increase and precipitation shifts from snow to rain, the frequency of intense rainfall events at Tahoe City is increasing. This, combined with the increased drought stress on plants during dry years, is likely to increase soil erosion.



The Warming of Lake Tahoe

From 1970-2007, lake temperature increased at an average rate of 0.013 ºC per yr. The warming is driven by primarily by increasing air temperature, and secondarily by increasing downward long-wave radiation. The net rate of heat input to the lake averaged 0.7 Watts/m^2 over this period, close to the global average of 0.8 Watts/m^2.





Source: Monika Winder, TERC

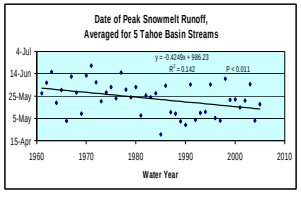
The warming trend is increasing the duration of the lake's thermal stratification and its resistance to mixing by wind. The increased stability may interact with increased input of nutrients and fine sediment to decrease the lake's clarity.

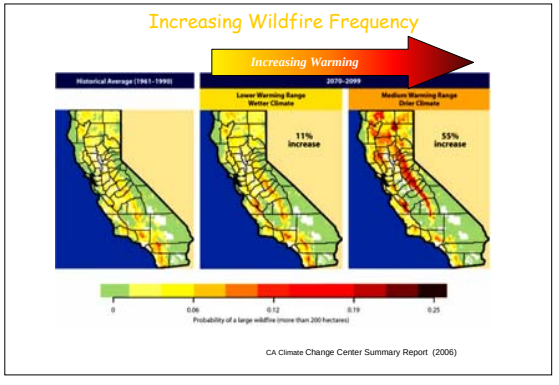
A reversing thermometer, accurate to 0.02 ºC

U.C. Davis Research Buoy

Increasing Risk of Catastrophic Wildfire

At Tahoe, increasing springtime air temperatures are shifting the timing of snowmelt toward earlier dates, at a rate of about 0.4 days/yr. As elsewhere across the western U.S., earlier snowmelt, warmer and drier summers and a legacy of logging and fire exclusion are combining to increase the risk of wildfire.





CA Climate Change Center Summary Report (2006)

Photo by Steve DeVries

In June 2007, these factors came together to create the Angora fire near South Lake Tahoe, which burned 3100 acres and destroyed 254 homes. Watershed as well as property damage was extensive.

An aggressive vegetation management program is needed in the Tahoe Basin to reduce the risk of wildfire.