Sierra Nevada Network
Climate Change Resource Brief

Pacific West Region
Inventory & Monitoring
National Park Service
U.S. Department of the Interior

Snowpack and Water Dynamics

Most SIEN precipitation falls in the winter as snow, with the resulting snowpack acting as a natural reservoir for water that is released in warmer, drier months. Atmospheric warming is resulting in an increase in the fraction of rain: to snow, decreasing the maximum snowpack water content, and causing earlier melt of the snowpack. The network is monitoring resulting changes in water dynamics—which are a critical component of the California freshwater infrastructure, as well as the parks' ecosystems—in multiple contexts, including monitoring and analysis of snow pack and melt, lake outflow and stream flow, and wetlands hydrology.

Water dynamics in the Sierra Nevada are dependent on snow melt (here snow and ice on Palisade Glacier melt into a Sierra Nevada lake)

Small Mammals Track Climate Change

A SIEN biological inventory project with University of California - Berkeley cooperators, re-sampled a 1914–1920 survey of small mammal communities in Yosemite National Park. By re-sampling a transect across a 3,000 m elevation gradient, researchers found upward changes in elevation limits for half of 28 species inventoried, consistent with the observed ~3ºC increase in minimum temperatures. Other recent inventories have confirmed that cooler, higher-elevation habitats are critical to the life cycle of many bat species, especially for winter hibernation. Several species may be at risk in SIEN because of their apparent requirements for high elevation habitats. These species include the little brown bat, which appears to occur only at elevations above 5,000 feet, the silver-haired bat, which has been found only in a limited elevation range, and the Townsend's big-eared bat which hibernates at high elevations.

Paddling out to collect mid-lake samples in McGee Lake in Kings Canyon National Park (SEKI).

Five-Needle Pine Monitoring

SIEN is coordinating development of a multi-network 5-needle pine protocol for whitebark pine, limber pine, and foxtail pine. Already threatened by blister rust caused by a non-native pathogen, these species may also experience increased incidence of pine bark beetles and changes to growth, death, and establishment rates. Recent research in California's White Mountains has found a link between warmer temperatures and increased growth rates of the oldest known 5-needle pine species, bristlecone. Foxtail pine remains a highly valued resource even after death as the wood is invaluable for tree-ring research and reconstructing millennial-scale climate records.

Landcover Change, Phenology and Fire

In our predominantly wilderness parks, it is costly to collect ground-based data. Therefore SIEN staff and cooperators are developing protocols for using Landsat and MODIS data to remotely monitor changes in vegetation cover and pattern, vegetation condition, fire regime characteristics, phenology, and snow cover. Use of this remotely-sensed data will provide an opportunity to detect and interpret changes at the larger scales that drive the incidence of fire, the spread of pathogens and insects, and other network wide trends.

Vegetation mapping is a valuable tool for monitoring vegetation, such as stands of foxtail pines (*Pinus balfouriana*), shown here in the Kern River watershed of Sequoia National Park (SEKI).

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