



LAKE MONITORING

IMPORTANCE – High-elevation lakes are critical components of the parks’ ecosystems, popular visitor destinations, and habitat for aquatic and terrestrial organisms, including declining amphibian species. Lake ecosystems were selected for monitoring because they are 1) valued for their ecological importance, contribution to Wilderness character, recreational opportunities, and importance to regional water supplies, 2) threatened by multiple stressors, and 3) sensitive to environmental change. Sierra Nevada Network (SIEN) parks protect over 4,500 lakes that have some of the highest water quality in the Sierra Nevada. However, they are subjected to stressors that have the potential to adversely affect them. The stressors with greatest concern are air pollution (e.g., increased nutrient inputs), climate change, non-native invasive species (e.g., fish), and localized visitor impacts. Lakes are good indicators of aquatic and terrestrial ecosystem condition because they reflect changes within the larger watershed. Sierra Nevada lakes are especially sensitive to environmental change because the waters are very dilute and thus small changes can result in pronounced ecological effects. The primary objectives of this protocol focus on monitoring water chemistry (18 different water quality parameters) and water quantity.



Dena Paolilli collecting water samples from a Sequoia & Kings Canyon lake. Photo: Scott Roberts.

RESULTS – In 2011, we completed sampling all four sets of lake sites in Sequoia & Kings Canyon and Yosemite national parks, thus 76 lakes across the network parks have been sampled since 2008. The network has emphasized nutrient monitoring in high-elevation lakes. In particular, effects of atmospheric nitrogen deposition—a primary Sierra Nevada stressor—on both aquatic and terrestrial habitats, are of high interest to managers and scientists and one of the primary reasons for selecting lakes for monitoring. Analyses of our first two years of monitoring data indicate that lower concentrations of nitrate generally occur in Yosemite compared to Sequoia and Kings Canyon. For our four index sites, which were sampled monthly during the field season, we can analyze multiple data points within one season. These sites show that high nitrate concentrations in the early season decrease over the summer and fall, consistent with previous research and monitoring in the parks. Click on [2008-2009 report](#) to download the full report and get additional information. We met budget reduction needs by reducing the number of index sites to two by 2011, and replacing difficult lake outflow stage and discharge measurements with lake level and temperature monitoring.



Josh Baccei heading out for mid-lake sampling in Yosemite. Photo: Scott Cereghino.

DISCUSSION – The lower concentrations of nitrate we found in Yosemite are likely attributed to lower rates of atmospheric deposition there. Sequoia and Kings Canyon have higher deposition rates due to air patterns that concentrate pollutants in California’s southern Central Valley. These pollutants, which include nitrogen oxides produced from agricultural, urban, and industrial sources travel from the San Francisco Bay Area and down the Central Valley, where they collect on the western edge and rise into the parks. This additional nitrogen is then deposited in the parks as wet and dry deposition. Other factors that can contribute to nitrate variability across the network include watershed area, in-lake processes, and watershed characteristics such as vegetation cover and type, geology, and soils. The within season variation at the index sites reflects the pulse of nitrogen that comes during snowmelt early in the season and declines later as snowmelt decreases and more biological uptake of nitrogen occurs as plants and plankton grow and use nutrients.

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