

Sequoia National Park

The Sequoia National Park acid deposition project is a long term, interdisciplinary, multi-agency study of the effects of acid precipitation on natural ecosystems. The program collects baseline data on ecosystem processes necessary to detect subtle but potentially devastating changes in natural communities. The project is conducted both under the auspices of the National Acid Precipitation Assessment Program (NAPAP) and as a cooperative program with the California Air Resources Board.

In recent years there has been growing concern over the potential effects of atmospheric pollutants in California. However, without adequate baseline data it will be impossible to assess future changes in atmospheric inputs and their effects on natural ecosystems. The NPS is cooperating in this study with federal and state agencies and private organizations to quantify some pollutant inputs and selected ecosystem properties across a 2200 m elevation gradient in the southern Sierra Nevada of California. The study is designed to produce baseline ecological and input data. Specific studies include analysis of precipitation chemistry, atmospheric chemistry, aquatic chemistry and biology, soil chemistry, nutrient fluxes, vegetation structure and function, and impacts of oxidant air pollutants (ozone). The potential role of fire—a frequent natural occurrence in the area—in buffering the effects of acidic inputs will also be evaluated.

The study has successfully attracted the support and financial involvement of a number of federal, state, and private agencies. These include the California Air Resources Board, the U.S. Geological Survey, the U.S. Forest Service, NASA-Ames Space Flight Center, the University of California, the Electric Power Research Institute, the Southern California Edison Company, and the National Park Service. As a result of such interest, the program has rapidly developed into one of the most comprehensive ecosystem studies ever attempted in the State of California.

The principal goal of the Sequoia program is to develop baseline values for selected biogeochemical processes and aspects of ecosystem structure and function that are believed sensitive to acid precipitation and other anthropogenic pollutants. A first approximation of input/output budgets of water, hydrogen, and nitrogen for each of the study sites (watersheds) will also be obtained. Development of specific objectives for each of the many subprojects included in the program is the responsibility of the individual principal investigators.

Three primary study sites have been selected for intensive investigation. Spanning much of the local elevation gradient, the sites include low elevation chaparral, middle elevation mixed conifer forest, and high elevation subalpine communities. All of the sites are situated within the drainage

of the Middle Fork of the Kaweah River. Each site consists of a headwater drainage basin or watershed that is located distant from development and sources of local contamination. Extensive soil, vegetation, and lake surveys were used to assure that watersheds selected were representative of ecosystems of the southern Sierra Nevada.

At each primary study site, the following baseline measurements are made: meteorology; aspects of atmospheric chemistry, quantity and chemistry of rain and snow (Aerochem-metric weekly event samplers and bulk samplers at all sites, snow buckets, lysimeters and/or cores at the middle and high elevation sites); soil characterization and mapping; soil chemistry; stream discharge (quantity and chemistry); stream periphyton and invertebrate monitoring; litter accumulation and decomposition rates; nutrient fluxes; vegetation composition, phenology, productivity, biomass, and water stress; and plant tissue and soil nutrient analysis. The low elevation Elk Creek site is the focus of additional studies on dry deposition and throughfall chemistry. The middle elevation Log Meadow site is the focus of additional studies on forest productivity and biomass, root production, N mineralization rates, and ozone effects. The high elevation Emerald Lake site is the focus of studies on lake dynamics (physical, chemical, and biological aspects), lake sediment buffering, soil/water interactions, detailed snow hydrology and chemistry, and tree ring analyses of growth rates and trace element levels.

The Park staff has worked together with the California Air Resources Board and other cooperators to identify study priorities and assure integration of individual projects. The National Park Service has given high priority to providing a framework that would be attractive to potential cooperators. This has included development of the Southern Sierra Research Center (laboratory, office, and dormitory facilities) as well as a cadre of trained technicians available to assist in routine data collection activities. The Park staff has taken the responsibility for data collection in the areas of meteorology, precipitation chemistry, stream chemistry and hydrology, forest insects and disease, litter dynamics, and baseline vegetation plots. Other projects have been carried out either under contract or by cooperative agreement with university scientists or other federal and state agencies.

Findings to date document the occurrence of acidic precipitation and the existence of extremely sensitive ecosystems. While winter precipitation generally falls as relatively unpolluted snow, the occasional summer and fall storms that occur in the area contribute potentially significant pulses of hydrogen, sulfate, and nitrate. The granitic bedrock, thin soils, and alkaline lakes that characterize the Park have a low buffering capacity and thus are extremely sensitive to acidic inputs. Addi-

tional studies on the quantity and type of dry deposition occurring in the Park are needed to fully document deposition inputs.

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