United States Department of the Interior
NATIONAL PARK SERVICE
CHANNEL ISLANDS NATIONAL PARK
1901 SPINNAKER DRIVE
VENTURA, CALIFORNIA 93001

IN REPLY REFER TO:

Dear Jerry:

Enclosed is a prospectus which Gary and I prepared and then talked over with Tom Callaham. His suggestion was that if anything happens with expansion of the LTER System, it will be on a non-NSF sponsored basis and that we should be talking in terms of some sort of adjunct or associate membership.

We would appreciate it if your steering committee would discuss our involvement in the program at the meeting here next month. We would prefer some kind of official standing as an LTER site even if sponsorship by NSF (i.e., funding) is not available at this time.

We're really looking forward to the meeting.

Bill Halvorson
Research Biologist

For information
Not Action

LTER PROSPECTUS

PURPOSE

To explore the current possibilities of incorporating Channel Islands National Park into the NSF Long-Term Ecological Research (LTER) Program.

JUSTIFICATION

1. The area is of great significance, having been recognized as a National Park, a National Marine Sanctuary, and an International MAB Biosphere Reserve.

2. Its inclusion would add a much needed marine environment site and also provide for monitoring of a portion of the Mediterranean environment and therefore would be supplementing, not duplicating any situations that presently exist in the program.

3. It was identified in the Second Conference on Long-Term Ecological Measurements, held in 1978 for NSF, as being a potential site for both the marine environment and Mediterranean ecosystems.

4. The establishment of a long-term monitoring program was legislatively mandated in Public Law 96-199 which established the Park in 1980.

5. The National Park Service is committed to the development of an integrated program for monitoring the physical and biotic components of the marine and terrestrial ecosystems of the Park.

6. The science staff at Channel Islands National Park desires to gather the data being collected in such a form that it can be coordinated and/or incorporated into the data base being produced by the LTER program.

7. The developing monitoring program will readily form the core data base for a wide latitude of studies for the Channel Islands which already have a long history of scientific interest.

PHYSICAL SETTING

Channel Islands National Park is comprised of five of the eight Channel Islands off the Coast of southern California (Santa Barbara, Anacapa, Santa Cruz, Santa Rosa, and San Miguel). Land surface totals some 50,600 hectares (125,000 acres) and the park also includes an approximately equal amount of surrounding ocean and submerged lands. The northern chain of four islands (Anacapa to San Miguel) lies near the Point Conception biogeographic boundary between the northern cold-temperate (Oregonian) and the southern warm-temperate (Californian) biogeographic provinces. This boundary is approximately equal to the boundary between the central California and southern California sub-floristic provinces. The boundary, and the islands themselves, are strongly influenced by the mixing of cold California Current

waters from the north and west and the warm Southern California Counter-current waters from the south. Thus the park contains a biota representative of some 1600 km (1000 mi) of coastline. The area is entirely within the Mediterranean climatic region and the vegetation consists of island examples of the following Mediterranean ecosystems: grasslands, coastal sage, cactus scrub, chaparral, oak woodland, pine woodland, and riparian.

STATUS OF LONG-TERM RESEARCH PROGRAM

A. A step-down plan was developed to show, in a relational mode, all of the tasks required for a natural resources research/monitoring program in the park (see attached figure).

B. An annotated bibliography of the scientific literature on the park's resources was prepared with the assistance of 25 scientists. The bibliography contains over 4,000 entries.

C. The step-down plan lists 15 separate research/monitoring activities. For each of these a monitoring design study was planned with the following features:

1. Summarize the historical data available on the resources to be monitored.
2. Design specific standardized sampling techniques for analyzing population dynamics and long-term population trends.
3. Design standardized report formats.
4. Field test and demonstrate the efficacy of the sampling techniques, the analytical approach, and the reporting system.

D. An automated information management system has been developed to handle the data collected by these 15 long-term projects.

E. The research/monitoring projects and their status are as follows:

1. Pinnipeds (seals and sealions): Designed by D. DeMaster, National Marine Fisheries Service, this project has been underway since 1981, however there are data available going back to the late 1920's.

2. Sea birds: Designed G. Hunt, D. Anderson, and F. Gress, Univ. of California, this project has been underway since 1981, however there are data available going back to the early 1900's.

3. Tide pools: Designed by VTN Oregon, Inc., this project has been underway since 1982.

4. Visitation: Designed by G. Davis, National Park Service, this project has been underway since 1982.

5. Marine invertebrates: Designed by G. Davis, National Park Service and H. Frey, Calif Dept. of Fish and Game, this is in the design study phase and will be completed in 1986.

6. Island birds: Designed by C. van Riper, National Park Service and the Univ. of California, this is in the design study phase and will be completed in 1986.

7. Island vegetation: Designed by S. Veirs and W. Halvorson, National Park Service, this is in the design study phase and will be completed in 1986.

8. Marine plants: Designed by G. Davis, National Park Service, and H. Frey, California Dept. of Fish and Game, this is in the design study phase and will be completed in 1986.

9. Marine Fish: Designed by G. Davis, National Park Service, and H. Frey, California Dept. of Fish and Game, this is in the design study phase and will be completed in 1986.

10. Oceanic Environment: Designed by G. Davis, National Park Service, this is in the design study phase and will be completed in 1986.

11. Fisheries Harvest: Designed by G. Davis, National Park Service, and H. Frey, California Dept. of Fish and Game, this is in the design study phase and will be completed in 1986.

12. Weather: Designed by W. Halvorson, National Park Service, this is in the design study phase and will be completed in 1986.

13. Island Herptofauna: Designed by G. Fellers, National Park Service, this is in the design study phase and will be completed in 1987.

14. Island Mammals: Designed by G. Fellers, National Park Service, this is in the design study phase and will be completed in 1987.

15. Island Invertebrates: Designer of this study will be selected in 1984, the design study is scheduled to be completed in 1987.

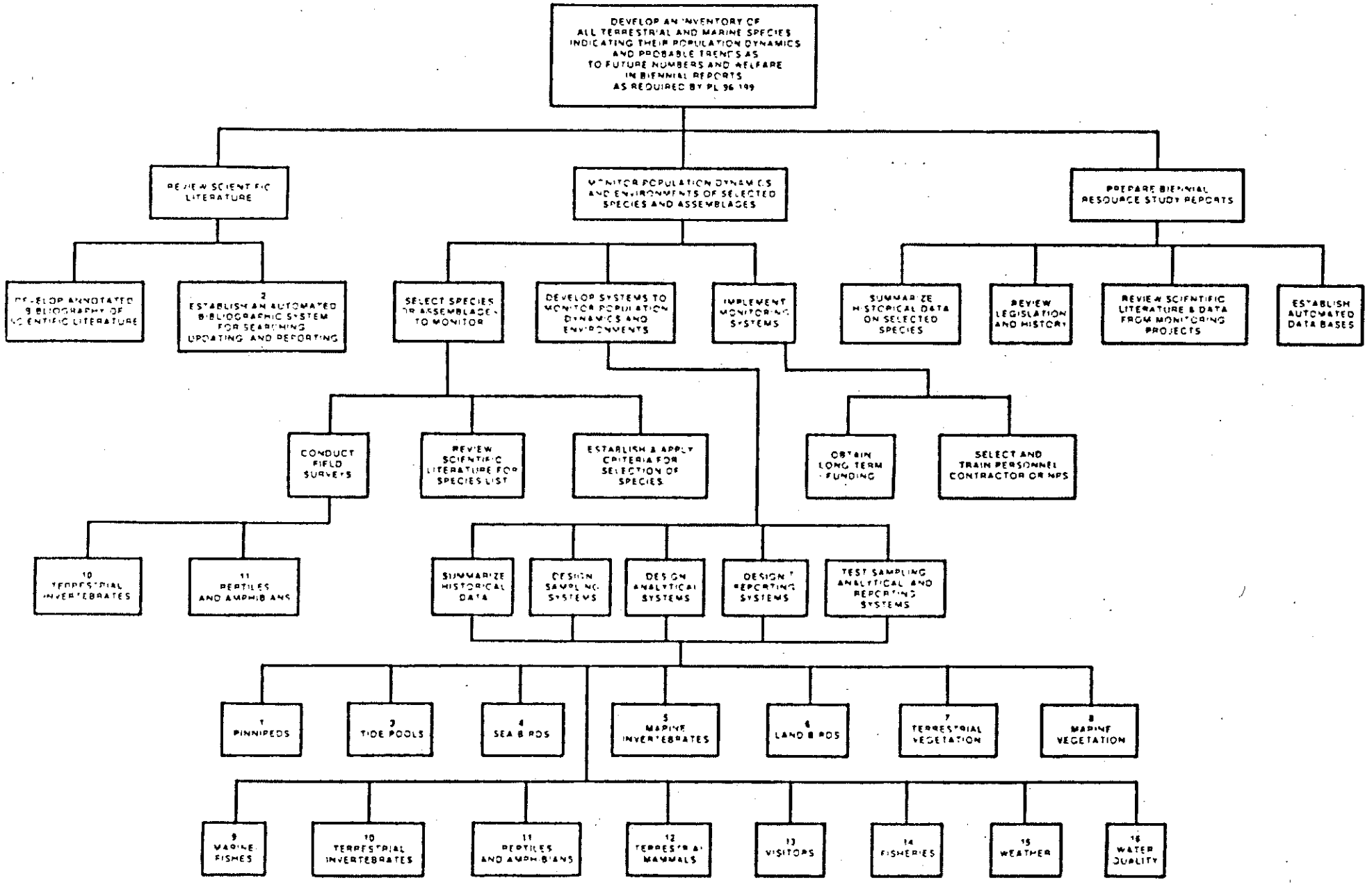
PROPOSAL

The long-term monitoring program outlined above forms a sound basis for Channel Islands National Park becoming a LTER site. In addition to this there are many research programs being conducted by the large number of universities and research institutions in the southern California area which supplement and strengthen this long-term effort. We are propsing that NSF consider the inclusion of this area into the LTER Program and look forward to the oportunity to discuss this concept further in the near future.

Gary Davis
Research Scientist

Bill Halvorson
Research Biologist

STEP-DOWN PLAN FOR NATURAL RESOURCES MONITORING AT CHANNEL ISLANDS NATIONAL PARK, CALIFORNIA



NUMBERS INDICATE PRIORITY OF PROJECTS ESTABLISHED BY SUPERINTENDENT, CHIS AND NATURAL SCIENCE DIVISION, WRO

Integrated Watershed Research Undertaken at Sequoia National Park

By David J. Parsons and David M. Graber

By David J. Parsons and David M. Graber

Park managers and scientists both are fond of bemoaning the lack of funds for baseline studies of the natural resources of our national parks. Yet when the development of a resource inventory or long-term monitoring program is priced against the more critical protection of a sensitive species or the resolution of a visitor/resource conflict in a priority-setting meeting, baseline data-gathering invariably loses out. Ironically, this ensures the continual generation of new crises – problems that develop unnoticed until they are obvious . . . and severe. There are few examples of the resource data bases necessary to adequately monitor the health of sensitive ecosystems in our national parks.

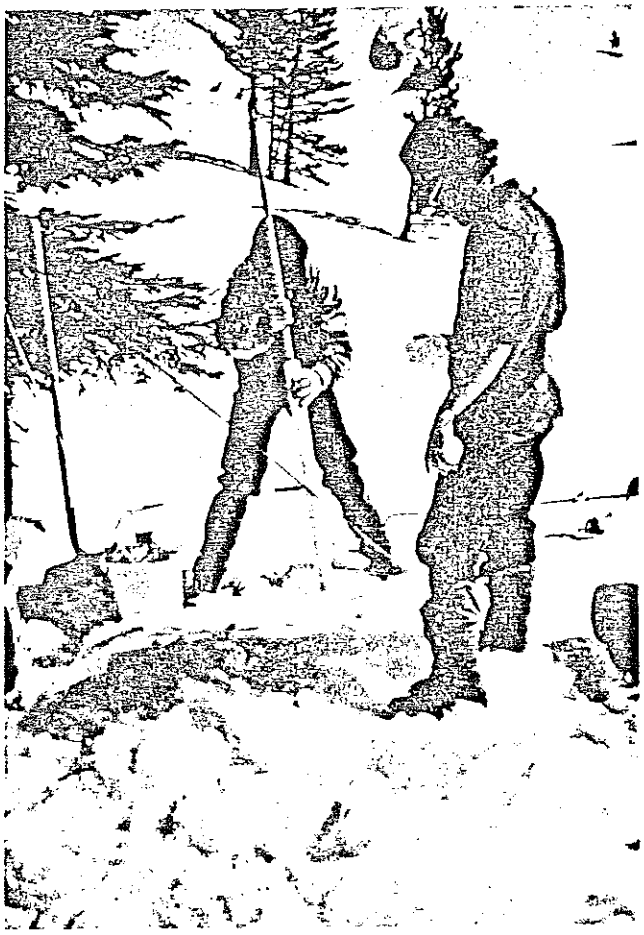
Acid Precipitation as a Catalyst

In Sequoia and Kings Canyon NPs we recognized some years ago our need for a modern, comprehensive, integrated resource data base including all major park ecosystems. Through normal budget processes it never was possible to obtain the necessary funds. In 1982 the Park was invited to become one of three NPS areas to embark on a long-term monitoring project as part of the National Acid Precipitation Assessment Program (NAPAP). Funding is provided by the NPS Acid Precipitation Program, a part of the Division of Air and Water Quality, under Ray Herrmann's direction in Fort Collins. The three National Parks (Sequoia, Isle Royale and Rocky Mountain – Olympic has since been included) were directed to develop coordinated programs to measure atmospheric inputs and to determine – and then monitor – ecosystem parameters potentially sensitive to acid precipitation.

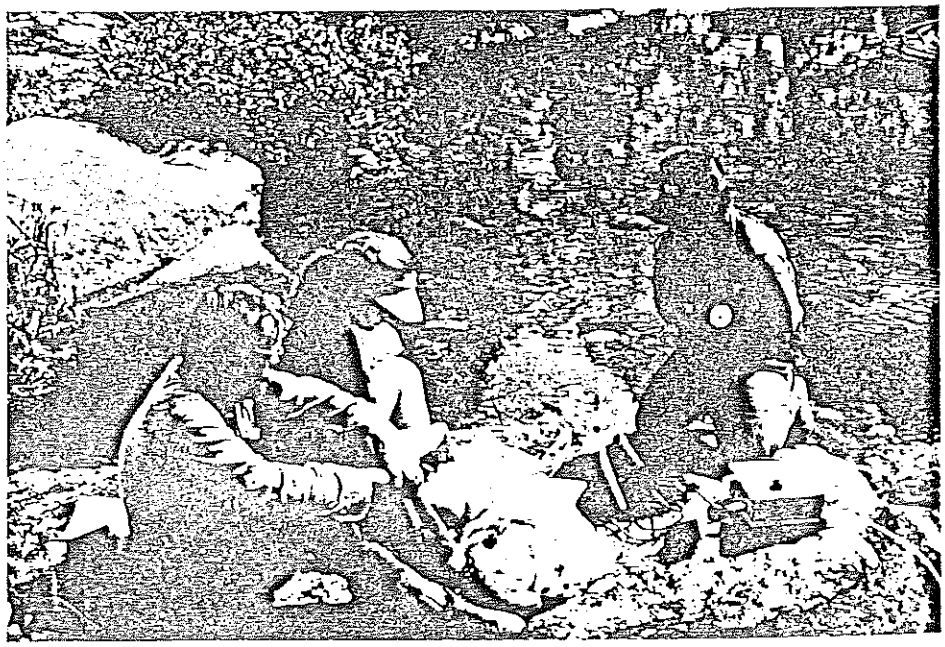
Sequoia was selected because of its location in the southern Sierra Nevada where poorly buffered granitic bedrock and low alkalinity lakes are challenged by significant air pollution, making it one of the most sensitive areas in the country to acid precipitation. The Park staff saw this as an opportunity to obtain much of the baseline data that had proved elusive for so long. In order to evaluate impacts from acid precipitation, it is necessary first to measure many of the same ecosystems parameters affected by visitor use, park operations, and a variety of threats to entire ecosystems: air pollution, exotic biota, island/boundary effects, wildfire suppression. Here was an opportunity to contribute directly to a major national research priority while simultaneously obtaining the data necessary to monitor the long term health of key Park ecosystems.

An Ecosystem Approach

In the early planning stages we decided that one of Sequoia's particular contributions to such a study is its elevation gradient, ranging from less than 400 meters at Park headquarters to more than 4,400 meters, at the top of Mount Whitney. The strong atmospheric inversion layer that develops during summer months, as well as differences in soil development, climatic regime, and vegetation suggest that major differences in susceptibility to anthropogenic pollu-



Synergy at work: Winter snow sampling (upper photo) and filtering of water samples for chemical analysis are part of the cooperative venture at Sequoia National Park, providing five years' support for high priority research in such areas as snow hydrology and chemistry, aquatic biology, soil processes, and tree ring and plant productivity studies – all contracted to university scientists working in the park.



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tants may exist at different elevations. We established three primary study sites (table 1) consisting of headwater drainage basins for which aspects of hydrological and chemical budgets as well as key ecosystem processes can be measured. In many ways we modeled our program after the highly successful long-term ecosystem study at Hubbard Brook, NH. It was apparent from the beginning that to execute our extensive plans it would be necessary to attract cooperative funds and extramural participation. While the modest NPS/NAPAP funds available for the project would support monitoring of input chemistry and a smattering of ecosystem measurements, they were inadequate to implement one integrated watershed study, let alone three.

As the scope of the study (and of the entire NPS program) was refined, priorities sorted themselves out. We assigned top priority to measurement of the quantity and chemistry of rain and snow entering the basins, and of streamflow leaving them. Although, we suspected – and still do – that dry deposition could be the most significant mode for pollutants entering our relatively arid mountain range, there are no generally accepted methods to measure such inputs. We have decided that measurements of dry deposition must await new technology and the formulation of EPA protocols. Other high priority studies included the chemical characterization and mapping of soils and the establishment of permanent vegetation plots to monitor plant species composition and demography.

As word spread about our program we discovered that others were interested in related or complementary studies and in many cases were looking for a place in California to carry out such work. Some of these scientists or agencies were specifically interested in acid precipitation and its effects, others in oxidant air pollutant impacts, and still others in particular structural or process elements of natural ecosystems. But all were attracted to the undisturbed aspect of park ecosystems, the cooperative integrated nature of the project, and the Parks' moral and logistical support for the endeavor.

Within the two years since the acid precipitation study first began, Sequoia NP has become a center for long term ecological research. Several federal agencies, the State of California, university scientists, and private industry have thus far participated in what has become a truly cooperative effort. While each party has its own specific interests, all have a common commitment to an ecosystem-level scientific program that will help make our world a better understood and safer place for future generations.

Cooperation

Cooperating investigators and funding sources as of fall 1984 are listed in Table 2. The U.S. Geological Survey has designated Emerald Lake a "calibrated watershed," one of a half dozen or so scattered across the country. The Survey has constructed a gauging station at the lake outlet, and performed chemical analyses of lake water using extremely sensitive detection limits, as its contribution towards building a water and ion budget for the watershed. The Survey also provided valuable information on the geology and geomorphology of the Emerald Lake and Log Meadow areas as an extension of a survey of groundwater hydrology carried out for the Denver Service Center.

National Park Service acid precipitation funds have been used to establish and survey the three primary study sites, including the selection of long-term vegetation monitoring plots. Inputs of rain and snow (both quantity and chemistry) as well as outputs through stream discharge and basic meteorological parameters also have been measured as part of a system of "core requirements" to be carried out at each participating park. NPS funds also have been used for research contracts at each participating park. At Sequoia, NPS funds have supported mapping soils in the drainage that includes all 3 study sites and for preliminary studies of soil chemistry, aquatic chemistry and biology, and effects of drought stress on plant phenology and water relations. Beyond its immediate utility, we believe that such information can serve to attract support and expertise for further investigations.

Interest of State university scientists in the developing study has been notable. The soils work has been supported partially by University of California Hatch Act funding obtained by the principal investigators. Dr. Jerry Franklin of the U.S. Forest Service in Corvallis, Ore., provided an early stimulus to data collection as well as instruction in handling cooperative ecosystem studies. Dr. Franklin combined NPS Interdisciplinary Science Team funds with Forest Service support to bring upwards of 50 scientists, technicians and students, primarily from Oregon State University, to take a "pulse" (short-term, intensive measurement) of the mixed conifer ecosystem at Log Meadow. This proved a stimulating experience and helped convince us that our program could be successful.

Less than a year into the program, NASA-Ames Research Center contacted us to learn if we would be interested in providing Sequoia as a field site for portions of NASA's new Global Biology program. NASA is testing remote sensing techiques to predict vegetative cover, litter fall and eventually nitrous oxide emissions from the soil as part of a broad effort to quantify cycling of key elements. While NASA has no particular interest in acid precipitation it is interested in finding a study site in the Sierra where basic ecosystem data is available. NASA-Ames is now directly supporting major studies of forest biomass/productivity and soil nitrogen flux in Sequoia. These are identified needs in the Park's research plan that had not yet been filled. Moreover, NASA has provided satellite and high-altitude aircraft imagery of the study sites, and invaluable technical advice on remote sensing, computing and development of a geographic information system.

More recent, but also most significant, has been the involvement of the State of California's Air Resources Board (CARB) in funding acid precipitation research; their entry promises to make the Sequoia program a fully functional ecosystem study. Following 1982 legislation calling for a five year multi-million dollar research thrust on acid precipitation, and after eager solicitation on our part, CARB selected Emerald Lake for the focus of its integrated watershed study.

Significant in its site choice was the work already accomplished, and the benefits of synergy. This cooperative venture provides five years' support for high priority research in such areas as snow hydrology and chemistry, aquatic biology, soil processes, and tree ring and plant productivity studies. These

TABLE 1. Primary study sites for long-term ecosystem study in Sequoia National Park.

Watershed	Type	Elevation	Area	Geology	Vegetation
Elk Creek	Intermittent stream	750 m	5 ha	Granitic	Chaparral
Log Meadow	Perennial stream	2,070 m	39 ha	Granitic	Sequoia mixed-conifer forest
Emerald Lake	Lake/stream	2,800 m	122 ha	Granitic	Subalpine

TABLE 2. Participants in acid precipitation studies, Sequoia National Park

Sponsor	Principal Investigator	Study	Site*
1. NPS	D. Parsons, D. Graber, T. Stohlgren, NPS	Project Coordination, meteorology, precipitation and stream chemistry, long term vegetation dynamics	1, 2, 3
2. NPS/CARB	J. Melack, S. Cooper, R. Holmes, UCSB	Aquatic biology and lake chemistry	1, 2
3. NPS/CARB/NASA	P. Rundel, W. Westman, UCLA; T. St. John, Colo. St.; S. Running, U. Montana	Vegetation and mycorrhizae studies	1, 2, 3
4. NPS/UC	G. Huntington, M. Akeson, UCD	Soils mapping	1, 2, 3
5. NPS/UC	R. Burau, L. Whittig, UCD	Soil chemistry	1, 2, 3
6. CARB	J. Dozier, J. Melack UCSB	Snow hydrology and chemistry	1
7. CARB	S. Nodvin, L. Lund, UCR	Soil processes	1
8. CARB	J. Harte, R. Amundson, UCB	Lake sediment buffering	1
9. NPS	P. Miller, USFS	Ozone effects	2
10. NPS	C. Wetmore, U. Minn.	Lichen survey	2,3
11. NPS	J. Moore, T. Sisson, C. Wahrahaftig, USGS	Geology	1, 2
12. USGS	V. Kennedy, R. Schroeder, T. Hunter, USGS	Stream chemistry and hydrology	1
13. MAB/USFS	P. Miller, USFS, and L. Lund, UCR	Dry deposition	3
14 CARB	T. Nash, Ariz. St. U.	Tree ring chronology	1
15. EPRI	R. Newton, Smith College and R. April, Colgate U.	Surficial geology and mineralogy	1
16. SCE	G. Bradford, UCR	Lake chemistry	1
17. NASA	P. Matson, NASA-Ames	N mineralization and canopy nutrients	2,3
18. NASA	L. Band, Hunter College	Digital terrain	1,2

*1 – Subalpine (Emerald Lake); 2 – Mixed conifer forest (Log Meadow); 3 – Chaparral (Elk Creek)

Park Science Reader Survey

Within the next few weeks, a readership survey will be conducted in order to help the editorial board and the editor of *Park Science* get a "feel" for what you like and what you miss finding in *Park Science*.

Scientifically prepared, easy-to-answer, vital-to-us questionnaires will be mailed to half of the single subscribers. If you get one, please take the time to fill it out and return it. We need to know how you would like to see us reshaped.

Results of the survey will appear in a future issue of *Park Science*.

Integrated Watershed

Continued from page 23

studies are all contracted to university scientists, some of whom already were working in the Park.

Private sector interest in Sequoia's program is evidenced by the Electrical Power Research Institute's (EPRI) funding of a study of surficial geology and mineralogy at Emerald Lake as well as by the Southern California Edison Co.'s support of both extensive lake chemistry and event precipitation chemistry.

Other studies currently or recently supported in the Park that relate directly to the ecosystem program include a Man and the Biosphere Program pilot study of dry deposition at Elk Creek; NPS Air Quality Division supported studies of ozone effects on conifers and oaks, and a survey of pollution sensitive lichens; and an EG & G National Laboratory preliminary study of trace element concentrations of air, soil, water, litter and vegetation.

Progress and Prognosis

Since the program is still in its infancy, there is little yet available in the way of hard data. Beginning this year, data and methods from Sequoia's ecosystem research program will be joined by a new research thrust to develop a Geo-based Resource Information System (GIS) that will combine historic, newly collected, and remotely-sensed geophysical and biotic information in "map" format. This will provide managers, scientists, and planners ready access to all available resource data for any given location in both Sequoia and Kings Canyon Parks. It is our hope that together with a comprehensive data base developed through the acid precipitation/watershed program the GIS will provide a model for natural resource programs in the National Park Service.

While the ultimate scope of the Sequoia program is a matter of speculation, it appears that the magnitude, quality, and accessibility of the data bases for the three primary study sites, as well as the extent of cooperation between federal, state and private interests, may prove to be the most comprehensive ever known to a National Park. Meanwhile, the effort stands as an example of what can be accomplished by combining a little seed money and a positive attitude toward the value of research.

Parsons and Graber are Research Scientists at Sequoia & Kings Canyon NPs.