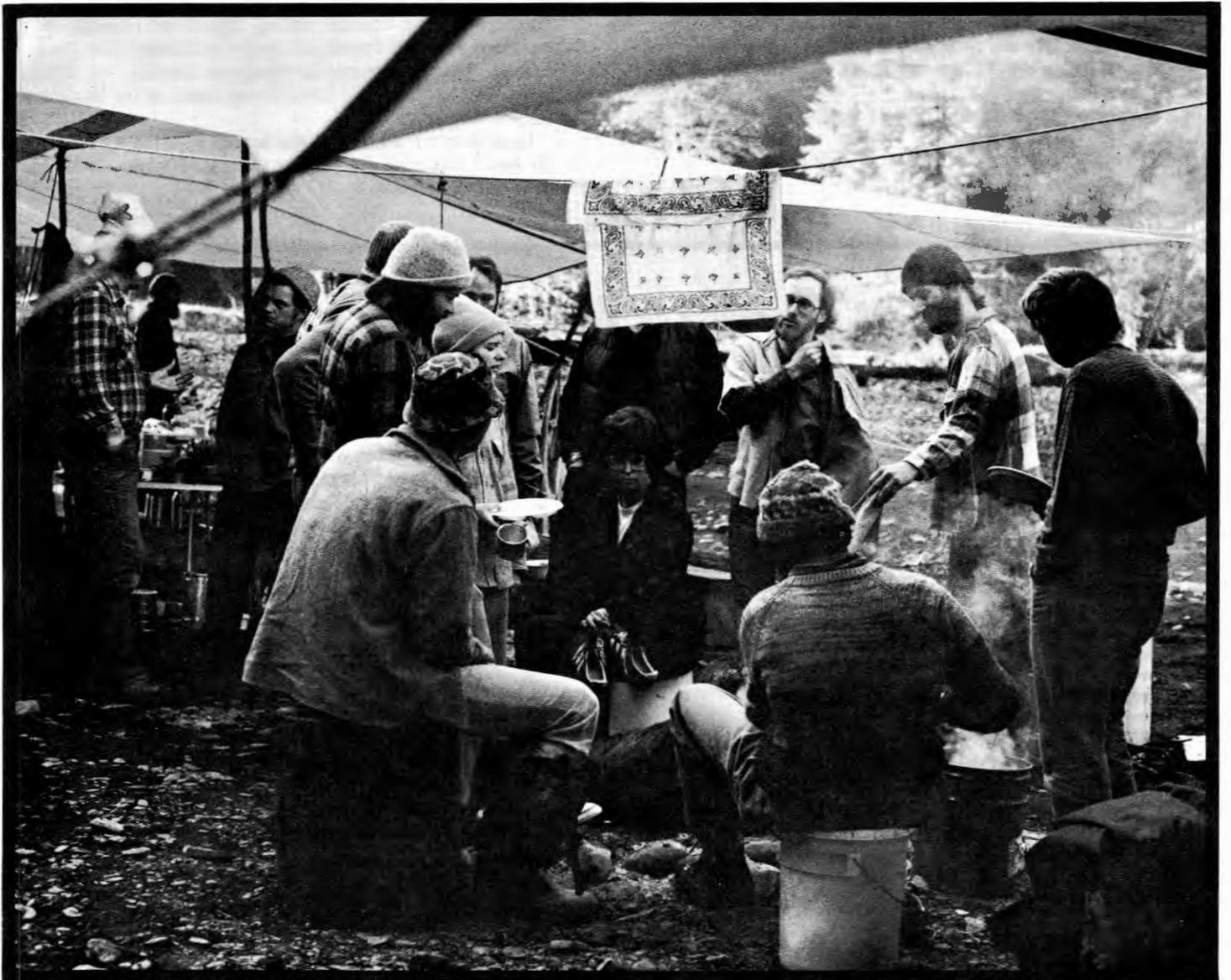




# PACIFIC PARK SCIENCE

FALL  
1980

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NATIONAL PARK SERVICE  
U.S. DEPARTMENT OF THE INTERIOR



# PACIFIC PARK SCIENCE

NATIONAL PARK SERVICE

## FALL 1980

**A report to park managers of recent and on-going research in parks with emphasis on its implications for planning and management**

### From the Director . . . . .

As former director of the Pacific Northwest Region, it gives me particular pleasure to welcome *Pacific Park Science* into the science/management process of the Western United States. The inspired concept of Cooperative Park Study Units had its birth in the Pacific Northwest Region just 10 years ago, and I see the newsletter as a logical extension of the CPSU function – to put the highest quality science to the most intensive use in managing and interpreting the resources this nation has entrusted to our care.

I made deliberate reference to the science/management process because it is the process nature of our function that I believe still needs attention. With mounting threats to the National Park System demanding our finest total effort, we have yet, as managers, to make full use of the tools science makes available.

It is the responsibility of science to gather information as a basis for management, to interpret the results of research, and to provide resource managers with alternatives. It is the responsibility of managers to increase their knowledge of science and the dynamics of the resources they manage.

Science and management must do more than just meet – they must mesh.

I was an enthusiastic supporter of the science/resource management workshops that were conducted for seven consecutive years in the Pacific Northwest Region. I saw the improvement in our operations that grew from the closer ties and better communication.

*Pacific Park Science* can act as an important link in holding together what I consider one of the healthiest developments anywhere in the Service – the evolving, interactive integration of scientific activities for park management programs.

I applaud the Western Region's move to the CPSU science format and its decision to cooperate in producing the newsletter. The university-based science programs continue to evolve in problem-solving ways, serving more than one park and capable of interacting at a national level to the benefit of both science and the National Park System.

The CPSU process embraces teaching, research and extension, and a measure of its success depends upon regular dissemination of information. I see the newsletter as bringing the management dimension more strongly to the fore, tying the CPSU functions more closely to the functions of resource management.

It is an effort that will need the attention and support of all park units in the West. I think it will pay enormous dividends for science, for management, and for the public.

Russ Dickenson, Director

### Cover

*A place to eat and exchange information, "the camp" was the heart of the Hoh River pulse study. (Story begins on opposite page.)*

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### From the Editor . . . . .

*Pacific Park Science* is designed to be a two-way street. We hope it will be a busy thoroughfare, and that is up to you.

From the editorial offices, we will go after as many stories as the issues will accommodate, and try to go in depth into as many as possible. But the real lifeblood of PPS will be your letters, comments, responses, ideas, gripes, bouquets, and leads. We want to hear about interesting ideas, books and articles you have discovered and want to share. We want your views on anything pertaining to park science and park management.

We'll describe on-going research in the parks of the West; we'll carry comments by the managers on that research and how it has been utilized. We will welcome management input as it concerns science and research – any comments about how it is serving, could serve better, or is missing the boat completely.

We want science to be recognized as an indispensable tool, and we want to help make it more useful – usable – than ever before. We don't think there is a better way to do that than simply to open wide a conversation on science and management in a region where the two already are working very well together.

The floor is open; the microphones are working – you're on!

Jean Matthews, Editor

# Cooperative Research Mix Aids Users, Preservers

The gathering of data on undisturbed land and the application of research results in managing for both multiple use and preservation is the crux of a cooperative research program involving the National Park Service, the U.S. Forest Service and two universities in the Pacific Northwest – Oregon State and the University of Washington.

Three cases in point – the Hoh river “pulse study” in Olympic National Park, the prescribed burn study at Lava Beds National Monument, and the on-board interpretation study of cruiseship travelers to Alaska, illustrate the two kinds of interaction involved – that among government agencies and universities, and that across scientific disciplines.

Managing an enormous, relatively pristine park in the face of equally enormous problems such as acid rain, air pollution and disappearing gene pools calls for measures based on knowledge as holistic as the set of circumstances that give rise to the problems.

An attempt to gain just such a knowledge base was made when Dr. Jerry Franklin of the USFS Forestry Sciences Laboratory at Oregon State University, Corvallis, organized a team of scientists to “take the pulse” of a wilderness drainage lying mostly within Olympic NP.

Results of the intensive research that filled 11 days and involved scientists, technicians and graduate students from 11 different organizations and a broad range of disciplines, will appear early next year as part of the first cooperative publications between USFS and NPS. As a General Technical Report, it will be published through the Pacific Northwest Forest and Range Experiment Station in Portland, Oregon.

In addition to an opening paper by Franklin, outlining the rationale and objective for the short-term intensive research effort in the Hoh drainage, six papers discuss various aspects of the research conducted during the pulse, one paper deals with closely related work done in the area at another time, and a final paper by Franklin, Frederick Swanson, USFS, and James R. Sedell, Weyerhaeuser Co., summarizes relationships within the valley floor ecosystems.

All seven of the individual “beats” of this pulse study contain information essential to management,

and together they extend understanding of north-western ecosystems to a distinctive variant (the rain-forest) and a larger scale (a river drainage).

Papers in the study deal with (1) Habitat and Food Resources for Invertebrate Communities, (2) Ecology and Habitat Requirements of Fish Populations, (3) interactions Among Fluvial Processes, Forest Vegetation, and Aquatic Ecosystems, (4) Structure, Composition and Reproductive Behavior of Terrace Forests, (5) Biomass, Coverage and Decay Rates of Dead Boles in Terrace Forests, and (6) Home Range and Habitat Use of Non-migratory Elk. Each of the papers contains management-specific discussion of research results.

At this stage of the search to bring science-based knowledge into the mainstream of park planning and management, the Hoh River pulse study is important for its demonstration of the numbers and types of data that can be gathered by an interdisciplinary research team in a short time span.

In their summary, Franklin, Swanson and Sedell deal with both the specifics and the generalities of the project. Specifically, they state that “the South Fork study demonstrates the use of a National Park and Biosphere Reserve as a benchmark site for scientific research and a control area for adjacent manipulated landscapes. The only remaining natural examples of river valleys in the coastal region are within the Olympic National Park.”

Generally, they describe the way they feel similar studies can be organized to produce maximum benefits for both science and management. “A successful project,” they say, “is based on substantial logistical planning and a balance between careful definition of objectives and ample opportunity to pur-

sue promising leads and for serendipitous discoveries.”

## Prescribed Burning

The prescribed burning research at Lava Beds National Monument is another case where research and management objectives both have been met through cooperative effort – Monument and Modoc NF personnel, working with Dr. Robert Martin and his USFS staff in forest ecology from the Silvicultural Laboratory at Bend, Oreg.

Historically, fires started by Indians or lightning occurred every 5 to 15 years prior to the advent of successful fire control. Fire control and a catastrophic outbreak of western pine beetles in the late 1920's, coupled with heavy grazing at the turn of the century had contributed to heavy fuel accumulations and a greatly modified vegetation cover.

Management objectives for the Lava Bed burns were four: to restore “historic” vegetation sequence, to reduce accumulated fuels, to train personnel in fire use, and to develop fire management plans and programs.

Research objectives, which dovetail and in some cases overlap those of management, were to develop burning techniques and prescriptions appropriate to achieve management objectives for fuel and vegetation, to record effects of fire under differing conditions, and to develop cost data.

Burning techniques have been developed over the years from 1974 to the present and effects on vegetation have been measured. The information NPS management with its problems of preservation and maintenance, state park and wildlife agency personnel – all usually restricted to their own institu-



*Nurse log gives rise to this standing row of trees, mute testimony to the essential role of dead wood in forest regeneration. (page 1.)*



*Parklike lower terrace (above) of the Hoh River valley is dominated by Sitka spruce. Upper terrace (below) consists of denser stand of mixed Sitka spruce and Western hemlock. (page 2.)*



gathering will continue regarding the effects of fire on flora and fauna over the long term. Larger burns fit into plans for fire management planning and have provided cost data for planning future burns.

Of interest to managers is the finding that even two or three prescription fires to reduce fuel loadings in one area to manageable levels are less expensive on a per hectare basis than the cost of the catastrophic wildfires they can prevent.

### **Cruiseship Study**

The sociological research undertaken jointly by the NPS and the University of Washington's College of Forest Resources adds the important "user" or "visitor" dimension to the scientific research programs underway in the Pacific Northwest. Animal/human encounters as part of backcountry experiences, profiles of backcountry campers and their perceptions of "crowding," and studies of the characteristics of hiking parties, for example, are aiding management at such parks as McKinley and Olympic to assess the extent to which users are complying with backcountry regulations as well as how they can influence and then meet user expectations.

Better preparation of visitors and improved interpretive processes could result from the study recently completed of cruiseship passengers traveling to Southeast Alaska. Five types of tourism — ethnic, cultural, historic, environmental and recreational — were found to contribute to the overall lure that brings visitors in this way to such places as Glacier Bay. The study pinpoints peaks and valleys of traveler interest and suggests several better ways to arouse enlightened curiosity and then when and how to satisfy it.

Analysis of the study by a University of Washington research assistant, Barbara Koth, and Roger Clark, recreation research project leader with the USFS Pacific Northwest Range and Experiment Station, working with Dr. Donald Field, suggests specific ways that interpretive offerings can be matched to passenger behavior patterns. Periodic updates and modifications can make cruiseship interpretation sensitive to both shortterm and longrange management goals.

It is the Cooperative Park Studies Unit approach now in effect throughout the Pacific Northwest and the Western Regions of NPS that provides the process pathways where creative synergism can work — to the benefit of both science and management. University faculty and graduate students, research scientists from the National Park and other Services,

tional bailiwicks – can interact beneficially as they deal with mutual or overlapping problems in an economic, holistic way.

The total knowledge gained in such efforts has more meaning than the mere sum of its parts. In addition, such efforts sometimes can incorporate previously gathered data that may have lain around for years, uninterpreted and unused.

The human squeeze for space and resources impacts national parks, national forests, fish and wildlife – preservers and manipulators alike. Add the crunch of shortened funds and energy and the impetus emerges to bring together scientists from a wide variety of missions in ways that are startlingly different from the patterns of the immediate past.

In the Hoh River study, for example, the Forest Service recognizes the relatively untouched national park natural areas as gene pool repositories and as benchmarks for environmental monitoring, providing information that cannot be found in managed, highly manipulated forests. On the other hand, the intensive management research the Forest Service has pursued from the beginning has produced and continues to provide important knowledge that can show NPS managers how to maintain and perpetuate the natural resources it is their mission to protect.

## **INTERPRETATION Of Energy In General**

Science as a solid base for interpretation probably has no better showcase than the energy story, where environment, economics and ethics all play a role in today's need for conserving and economizing. The University of Idaho Cooperative Park Study Unit in Moscow has produced a 34-page guide to energy interpretation that offers valuable tips for managers and interpreters who want to identify and utilize the energy interpretation opportunities in their parks.

The booklet was produced on contract for the Idaho Office of Energy as a guide for state park personnel, but its general approach and splendid References Cited and Annotated Bibliography sections make it an unusually useful tool for the interpreter who wants to develop a scientifically sound program without having to wade through a graduate course in thermodynamics. Gary E. Machlis,\* Sam H. Ham and Robert P. Deyerberg (who wrote the book) take you to the promised land without dragging you through the desert.

The book focuses on energy interpretation as "the presentation of energy-related ideas in such a way

as to make these ideas meaningful and important to visitors." Throughout, the book suggests ways to relate facts and concepts to visitors' own personal experiences. The basic energy principles (which are not easy to grasp) are given fresh, relevant, accurate airing in ways that lead to increased awareness and understanding. Guides to deeper study are provided for the energetic, curious, ambitious interpreter.

Dispensing with jargon, clever use of analogies, development of topics and themes that relate to both the park and the visitor's home environment are dealt with in the context of both the energy subject matter and the interpretive process. The result is a document whose usefulness extends far beyond the Idaho state borders.

A well known axiom in communications is the one that goes "If you really want to learn, teach someone." Parks that undertake the communication of the energy story often wind up doing the top-notch management jobs. Such a story has pay-off points at both ends.

Understanding the way energy flows through systems – natural, humanbuilt, and the interfaces between the two – can "save a bundle" for those who put their knowledge to practical use. And in addition to management savings, there are personal rewards, as Supt. Betts and Site Energy Coordinator Matthews at Mount McKinley, and Supt. Hentges and SEC Harrison at Craters of the Moon found out recently when they received incentive awards.

Energy consumption in buildings at McKinley was reduced 43 percent per gsf; gasoline use was lowered 32 percent and diesel fuel, 41 percent. At Craters of the Moon, building use energy came down by 47 percent and gasoline consumption by 20 percent. Both parks had initiated demonstration projects and they went on to prove that they listen to themselves when they tell others about energy conservation. (Awards story first reported in PNR Energy Newsletter, 4/80)

\*Dr. Gary E. Machlis is Assistant Professor of Wildland Recreation Management and Sociology Project Leader, CPSU, College of Forestry, Wildlife and Range Sciences, University of Idaho; Mr. Ham is instructor of Wildland Recreation Management in the College of Forestry, Wildlife and Range Sciences, U of Ida.; Mr. Deyerberg is a graduate assistant for the U. of Ida. CPSU and a graduate student in Wildlife Recreation Management at the College of Forestry, Wildlife and Range Sciences, U of Ida.

**Energy Interpretation: A Guide for Idaho State Parks can be had by writing to Dr. Machlis, College of Forestry, University of Idaho, Moscow, ID 83843, and enclosing \$1. If checks are used, make them payable to College of Forestry.**



**CHINA GATE**

**CHINA GATE:** The United States has its yellow stone – the People's Republic of China has its yellow mountains. Both are honored parks. This photograph, taken by Dr. Gary E. Machlis, sociology project leader at the University of Idaho CPSU, is the entrance gate of Huangshan (yellow mountains) provincial park in Anwei Province. Machlis has just returned from two months' stint in China, where he

taught a four-weeks course on Forest Recreation Development in China at the Nanking Technological College of Forest Products for 60 faculty and park managers from throughout China – the content to be published in Chinese next year. Machlis spent his second month traveling extensively in China, visiting urban parks, tourist developments and potential national parks. His impressions will be carried in the Winter issue of the newsletter.

## INTERPRETATION

### Of a Volcano In Particular

Seldom does a scientific event spark the public's interest and imagination to the point where more than superficial tolerance for information is achieved. In the case of Mount St. Helens, the public thirst for knowledge seems unquenchable, and Glenn Hinsdale, PNR's unquenchable chief of urban and environmental activities, has come up with a superb piece of scientific interpretation.

Titled "Incident at Mount St. Helens," and published as an Environmental Quickie (a public service project obtainable from PNR's headquarters at 601 4th & Pike Building, Seattle, WA 98101), this 8-page publication is written with scientific integrity, historical perspective, newspaper-crisp freshness, and a sensitive appreciation for the intelligence of the audience. Congratulations to Hinsdale and to the Region for a timely interpretive job exceedingly well done.

## Air Pollutants Monitored At Biosphere Reserve

*Editor's Note: Science is the human way of organizing information to try to predict the future. Management is the human way of organizing action to try to influence the future. Scientific management in the National Park Service is the bringing of as much predictive capability as possible to the planning and operation of park units.*

*Cooperative scientific programs among agencies with impressive capabilities have made possible a variety of predictably salutary outcomes as the result of park management practices. Perhaps the grandest of schemes to have emerged within this general effort is the Man and the Biosphere (MAB) Programme, launched by the General Conference of*



*UNESCO at its 16th session in 1970, with the following aims:*

*"To develop within the natural and social sciences a basis for the rational use and conservation of the resources of the biosphere and for the improvement of the relationship between man and the environment;*

*"To predict the consequences of today's actions on tomorrow's world, and thereby to increase man's ability to manage efficiently the natural resources of the biosphere."*

*Of the 14 major international themes, or project areas, within the MAB Programme, Project 8 is a worldwide network of biosphere reserves, to include on a representative basis samples of all major types of ecosystems for in situ conservation and to provide sites for baseline research activities. Conservation of gene pools and whole ecosystem processes, integrated ecological research and environmental training activities are the heart of biosphere reserve rationale and work.*

*The Pacific Northwest and Western Regions of NPS contain 15 of the 35 U.S. biosphere reserves, where basic research is contributing to the ability of managers to track deterioration of the resources and to take preventive and/or corrective measures aimed at preservation of habitat and perpetuation of species.*

*As airborne pollutants circulate and settle in mounting quantities over expanding area, variously based scientists are pooling their knowledge and ef-*

*forts in air measurement projects jointly funded by agencies and institutions with mutual concerns. Meanwhile, talk of fuel-related development at Port Angeles, on the rim of the Olympic National Park and Biosphere Reserve provides context for research into present conditions at the park. Careful documentation of existing states will be crucial evidence in any future attempts to control human impact on the natural environment of that area.*

*The following report from Bruce Wiersma, ecologist with the U.S. Environmental Protection Agency's Environmental Monitoring Systems Laboratory in Las Vegas, Nev., goes one step further — comparing data collected from two biosphere reserves. It would seem from the data that the degree of an area's "pristine" could depend in large part on whether the prevailing winds blow in from several thousand miles of open sea or across a similar distance of industrialized land.*

**By Dr. G. Bruce Wiersma**

Our work at Olympic National Park this summer was supported by the National Park Service. In addition to NPS personnel from Olympic, we were assisted in this project by Sarah Greene, Forestry Sciences Laboratory, U.S. Forest Service, Corvallis, OR; Dr. Cliff I. Davidson, Carnegie-Mellon University, Pittsburgh, and Dr. Clyde W. Frank, University of Iowa.

Biosphere reserves are remote, pristine areas set

aside in perpetuity. A pollutant monitoring system is being developed for implementation on the reserves. Purposes of monitoring pollutants on these areas are (1) to serve as locales for background reference levels of certain pollutants, (2) to provide a frame of reference against which changes in impacted areas can be measured, and (3) to reflect changes of a global nature before such changes are obvious in more impacted areas.

The reserves are areas that can be used to monitor the behavior of pollutants that have long range transport characteristics. This project is developing a monitoring system for pollutants on biosphere reserves. Olympic NP was first sampled in the summer of 1979 and again in 1980. Samples taken included air, water, soil, forest litter, and vegetation. Sampling was coordinated with watersheds in the park. Watersheds sampled included the Hoh River, Quinalt River, and the Dosewallips. Pollutants of interest were trace elements, pesticides, and certain trace organics.

In the summer of 1980, special power systems were tested under field conditions. These power systems were used to operate the air monitoring equipment. Two types of power systems were used, a portable solar panel and a hydrogen fuel cell. The solar panel was designed to fit on a pack frame. Coupled with a battery system this unit could power the air sampling equipment for indefinite periods. Eight such units were deployed in the park; all performed in a highly satisfactory manner. Two hydrogen fuel cells were deployed. Both operated off a 30-lb. hydrogen cylinder. Both performed according to expectations.

The Great Smoky Mountains NP had been sampled previously and some of these data have been paired with results from Olympic NP. Copper and lead levels in moss and litter are compared here for the two biosphere reserves.

Comparison of moss samples from Olympic and Great Smoky Mountains NPs, (micrograms per gram):

	Copper	Lead
Moss – Olympic Summer	4.4	5.7
Moss – Smoky Spring	13.5	42.4
Moss – Smoky Fall	15.3	108.0

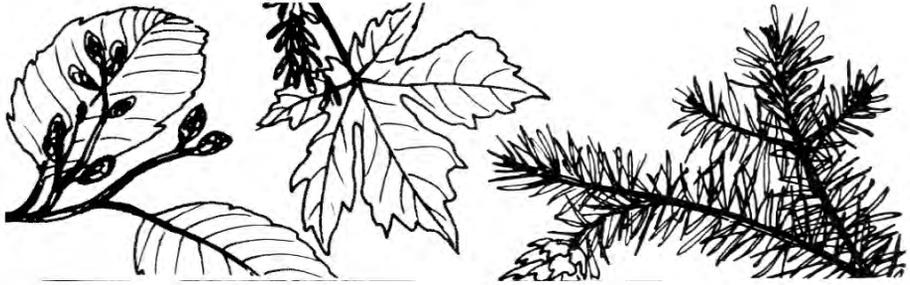
Comparison of forest floor samples from Olympic

and Great Smoky Mountain NPs, (micrograms per gram):

	Copper	Lead
Olympic – litter	10.0	16.7
Smoky – unincorporated organic matter – spring 1978	18.2	37.8
Smoky – fermentation spring 1978	26.2	83.6

exotic plant incursions into the Kipahulu Valley, all within Haleakala NP.

R. Gerald Wright, systems ecologist and formerly key man for the proposed Wrangells-Mt. St. Elias NP in Alaska, went to the University of Idaho CPSU in July as project leader in biology. His 1980 publication with Lynne Zeitlin-Hale of a conceptual ecological model of Glacier Bay NM was a major product of his four years in Alaska.



## PEOPLE AND PLACES

Douglas B. Houston, research biologist, has been transferred from the Rocky Mountain Region to the Pacific Northwest, effective October 5. Houston spent the previous 18 months at the Oregon State University CPSU in Corvallis, writing a monograph on his nine years' research on Yellowstone elk. He will be duty stationed at Olympic National Park, to work on ungulate habitat relations and to help park management identify aquatic research needs and priorities.

"I have the feeling," Houston said, "that there is a vast amount of fisheries information available as a result of research done by other agencies. My first job will be to review this research and interpret it in the light of Olympic park management objectives."

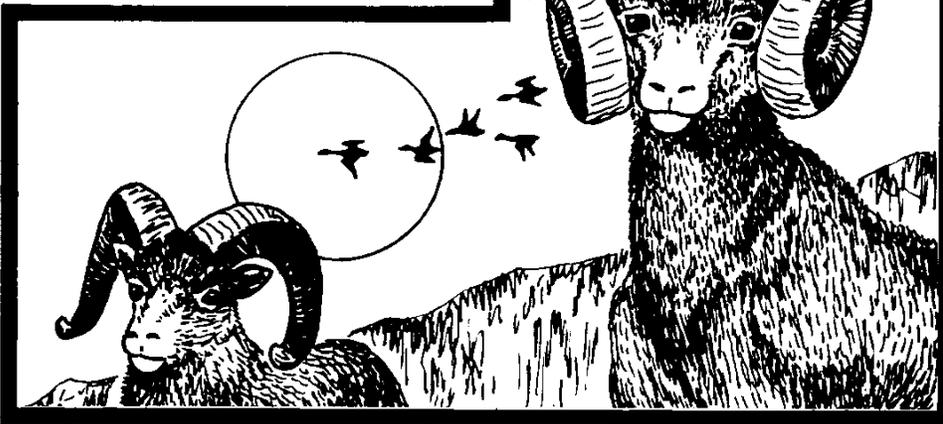
Two research biologists, Gary E. Davis and Lloyd L. Loope, recently made the continent-wide leap from the South Florida Research Center at Everglades NP to the NPS Western Region. Neither stopped at the water's edge.

Davis, a marine biologist, is at Channel Islands NP, beginning a Congressionally mandated inventory of all terrestrial and marine species in the park. (More details on p. 6.) Loope, a plant ecologist, made it clear to Hawaii, where he is working with endangered species such as silversword and with



DOUG HOUSTON

## Bighorn Study Identifies Two Viable Herds



A four year study of bighorn sheep in the Sierra Nevada was completed recently by Dr. John Wehausen as part of his doctoral research at the University of Michigan. Supported by a contract from Sequoia and Kings Canyon National Parks, the study identified two viable herds of bighorn remaining in the Sierra Nevada.

Minimum herd sizes of 217 and 30 individuals were established for the Mt. Baxter and Mt. Williamson herds. The Mt. Baxter herd is of special interest to park managers because the sheep summer primarily within the park along the Sierran crest. In winter they drop into the foothills above Owens Valley on land administered by the Inyo National Forest.

The study was undertaken primarily to determine the present status of the Sierra bighorn as well as make recommendations regarding their future management. Known to be widely distributed before the appearance of Europeans in the area, it has been hypothesized that competition with domestic sheep, impact of increasing recreational use and hunting all have had a hand in the drastic decline of the population.

Intensive field study indicates that the Baxter herd has been increasing since the 1960's. Lungworm infection is well below the levels known from other areas and there is no indication that diseases

presently play a significant role in the dynamics of the herd. Similarly, there appears to be little significant competition for forage on either the summer or winter ranges. Neither predation nor human disturbance appear to be significant factors in limiting the population.

Because natural colonization of new ranges is rare in bighorn sheep, it was determined that introduction would be required if expansion of bighorn range in the Sierra Nevada is desired. As part of his study, Wehausen identified a number of likely reintroduction sites based on historical distribution and ability of areas again to support sheep. He also recommended that the Baxter herd was, at the time, healthy enough to serve as stock for reintroduction.

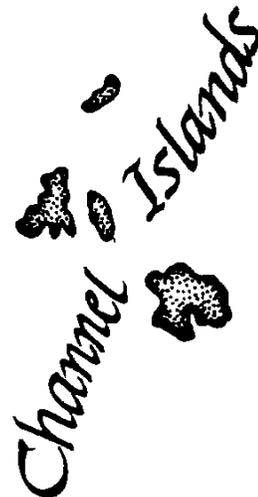
During the last two years a total of 40 sheep have been trapped from the winter range of the Baxter herd. All but 10 of these have been relocated to two sites within their historical range. Many of the sheep have been radio-collared and their movements currently are being followed by California Department of Fish and Game personnel.

Another management action stemming directly from Wehausen's research is closure of all lands above 10,000 feet within the bighorn range to cross country travel. This joint action by Park Service and Forest Service personnel has resulted in significant restrictions on peak climbing in the area.

## Channel Islands NP Resource Inventory Underway

The first step in conducting a Congressionally mandated inventory of all terrestrial and marine species in Channel Islands NP has been taken. A review and analysis of the scientific literature on the five channel islands and surrounding marine resources was contracted to Dr. Charles D. Woodhouse at the Santa Barbara Museum of Natural History in California.

Dr. Woodhouse, assisted by about 25 other scientists, will produce an annotated bibliography on the cultural and natural resources of the park. The work will help park planners and managers develop a comprehensive general management plan. Such a plan is required by Public Law 96-199, and must be submitted to Congress by October 1983. The literature review also will be used to help identify areas where additional research is needed to buttress management of park ecosystems and the substantial cultural resources found on and around the islands.



# Whattya Mean "Let It Burn"?!?!

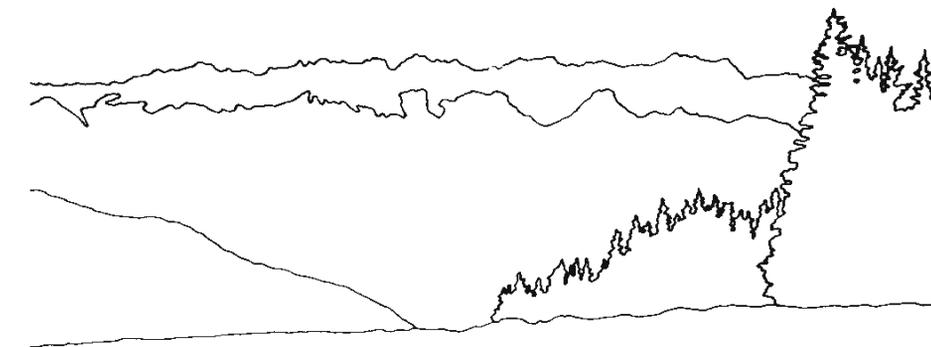
## Fire ~ An Olympic Event

Often it isn't enough simply to get the correct data on which to build resource management. When these data dictate practices that run counter to the "conventional wisdom," then a public information dimension is strongly indicated.

A perfect case in point involves the role of natural fire in management of forested areas. Human instincts and years of special pleading by Smoky the Bear have combined to create a public attitude of monumental skepticism toward fire as a management device.

At Olympic NP, Denison M. Rauw, research assistant in the University of Washington College of Forest Resources, conducted a two-year test aimed at assisting park management to establish contact with the local community, industry, state and federal land managers and park visitors with regard to the park's concerns on fire management. The idea was that fire management at Olympic NP must include careful consideration of resource values outside as well as inside park boundaries.

The two-year study began with distribution of a questionnaire to park visitors and peninsula residents, dealing with fire experience, fire knowledge and fire attitudes. During this phase, interviews were conducted with state, federal and private timber managers to define their attitudes concerning fires.



Despite evidence that residents and visitors had a fair grasp of the rationale behind prescribed burning, the 725 questionnaires completed and returned left no doubt that significant reluctance exists toward managing for natural fires in the park, regardless of management objectives.

Phase two was development of a slide tape program to increase public understanding. "Fire: An Olympic Event" was shown to park visitors and peninsula residents throughout the second summer. Phase three, conducted simultaneously, was administration of a quiz before and another after the slide tape program showings.

To the pre-season questionnaire, a majority of respondents agreed that not all fires are destructive and over half felt that fire benefits some species of wildlife, but their attitude toward establishing a natural fire zone within the park was nevertheless, negative. Sixty-five percent felt all forest fires should be controlled at any cost, whether in a national park or a national forest.

Most support for a prescribed burn was given for hazard fuel reduction and restoring native vegetation. Less was given for fire with respect to scientific research of insect/disease control.

Most significant finding from questionnaire analysis was that the independent variable – knowledge about fire – accounted for most of the total

variance of each fire attitude. Other independent variables – age, fire experience, education, residence, and previous fire losses – were only weakly associated with fire attitudes. The conclusion was obvious: that a change in knowledge would be most likely to influence a change in attitude toward fire.

Phase three – the pre- and post-show fire quizzes – showed statistically significant increases in fire knowledge after viewing the slide tape program. The average number of questions missed on the pre-show test was 3.5; the average on the post-show test was 1.8. Most dramatic change was scored on the wildlife question, where correct answers shot from 33 percent before the show to 88 percent afterwards.

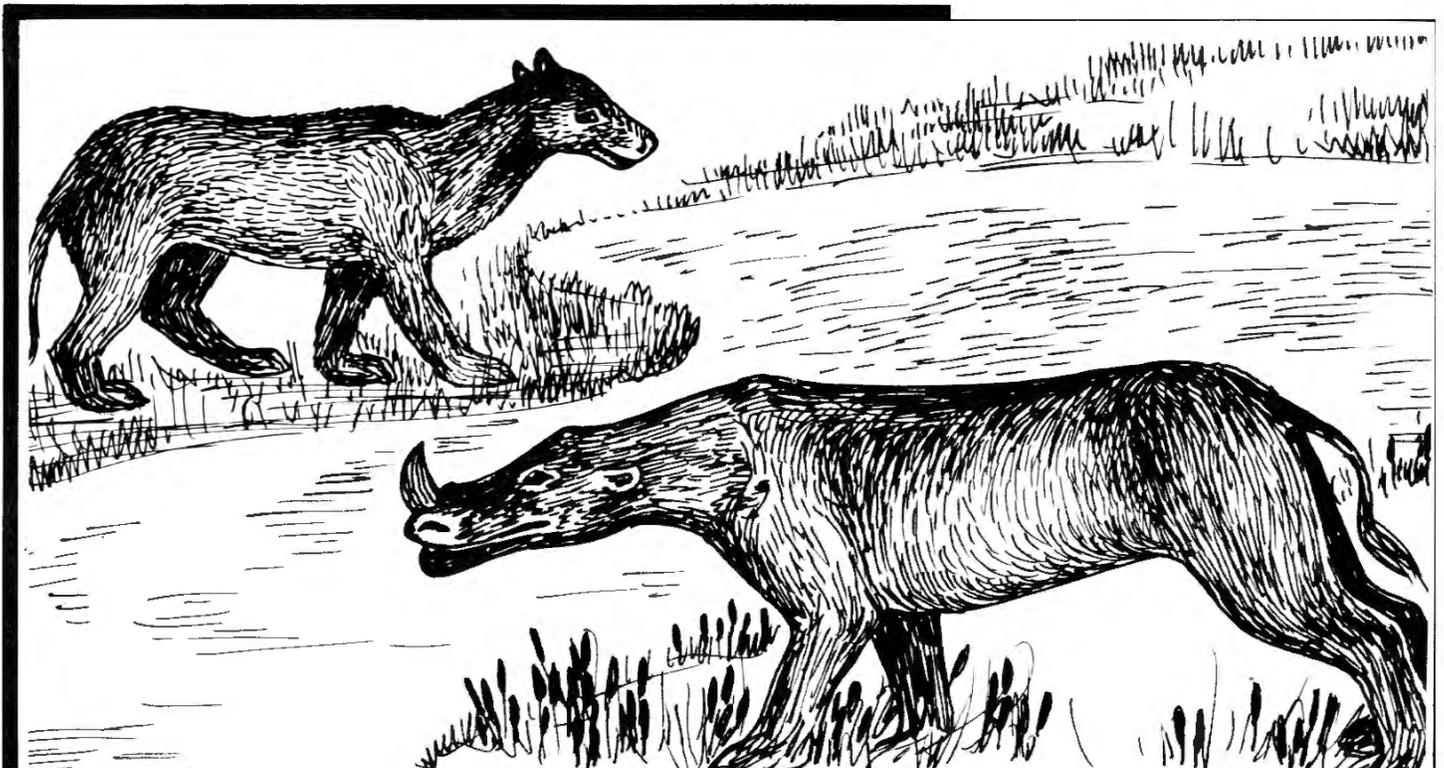
The study gives solid statistical backing to the decision of managers and interpreters at a number of park sites to actively work toward increasing visitors' fire knowledge. At Olympic, park management is confident that this broader appreciation of fire will gain valuable visitor and community support for future fire policy.

The study was a joint research project of the NPS and the University of Washington CPSU. Also involved were Steward G. Pickford and James K. Agee, associate and assistant professors respectively at the University's College of Forest Resources.





**ASST. ZOOLOGY** Professor John Ruben watches as Student Nancy Becker uses an air-scribe to clean away the matrix in which the bones of this "biting cat" were preserved. In the background is a cast of the skull of an oreodont. Both fossils were unearthed at John Day Fossil Beds National Monument, where plant and animal fossils show five epochs, from the Eocene to the end of the Pleistocene. Superintendent Ben Ladd credits Ruben with locating a number of fossils – "a feat for which we don't have the professional capability ourselves." Dr. Ruben is a paleontologist as well as a zoologist, and he has used the DSU lab, fully equipped for fossil preparation and replication, to produce exhibits that Ladd describes as "adding immeasurably to the park experience." Ladd said reproductions are being set up under plastic bubbles at approximately the locale where they were discovered, and Ruben is supplying the data for park interpreters to use in telling the story. Ruben is now available to the NPS as a consultant on retainer, his services including full use of the OSU labs costs the Park Service \$3500 a year.



# Look What We're Doing!

Five separate publications describing the scientific research projects in the Pacific Northwest and Western Regions now are available. The 91-page PNR Annual Science Report for 1979 is an expanded version of the usual report, in response to the absence of the traditional Science/Resource Management Workshop, held for three days in each of the previous seven years. It includes a paper developed by Jim Agee, Don Field and Ed Starkey on the Cooperative Park Studies Unit concept that summarizes the history and function of CPSU's and includes guidelines for research contracts in parks. Selected abstracts from investigators' annual reports comprise the remainder of the publication. It can be had by contacting the Science and Technology Division, Pacific Northwest Region, 601 4th and Pike Building, Seattle, WA 98101; (206) 442-1355 or FTS 399-1355.

The Western Region's research output is contained in separate reports, one from each of the four CPSU's - University of California, Davis, CA 95616; University of Hawaii, Honolulu, HA 98622; University of Arizona, Tucson, AZ 85721; and University of Nevada, Las Vegas, NV 89154. The information given is largely of a preliminary nature and was prepared primarily on an interim basis, but a reading of the documents (approximately 20 to 25 pp each) provides a broad view of the kinds of research being conducted and an educated clue as to how management and interpretation are being served.

**Sociology Studies Program: 1978-1979**, recent publication of the CPSU at the University of



needs and behavior of people in parks), and applications of research to resource management (such as management assessments and reports, backcountry monitoring programs, interpretive program analysis, visitor monitoring programs and the development of a framework for assessing social impacts.)

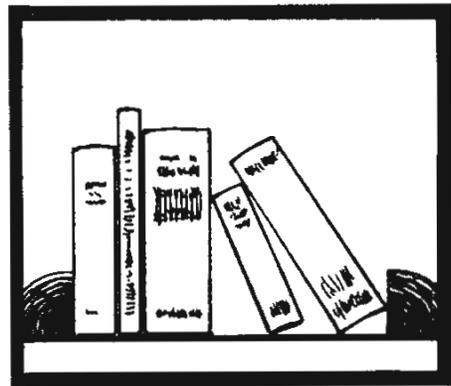
Washington College of Forest Resources, provides information about sociological research and reports efforts to apply the findings to resource management and interpretation. The book focuses on highlights of the program and describes products that have proven useful to management, as well as publications stemming from the research and now in production.

An interagency agreement among the National Park Service, U.S. Forest Service and College of Forest Resources at the University of Washington continues to undergird the conduct of social science research into problem areas pertinent to park management. The work falls into three broad categories: baseline studies (regional studies designed to promote understanding of human leisure behavior and the participation patterns of people in selected recreational activities, park-based studies (a wide variety of research problems concerned with

The park-based studies are undertaken in response to requests by management and are site-specific. In this category, the Sociology Studies Program has concentrated on providing information for the backcountry and for interpretive plans. An example of the latter is the cruiseship interpretation study described in this issue (p. 2). The computerized backcountry permit information system - a major project begun in 1973 and turned over to Washington, D.C. in 1976, was conducted with frequent management input - a design component that runs throughout sociological research. In this case, the work led to reorganization of travel zones by ranger district, redefinition of travel zones, addition of a page of summary information, and a regional summary for all the major parks of the Pacific Northwest Region.

The 1979 sociology program personnel, under project leader Don Field, consisted of Neil H. Cheek, Jr., research social scientist, and research associates Darryll Johnson, Barbara Koth, Maureen McDonough, Gary Machlis, Pat Stkowski and Peter Wombie. Laurie Briggs, programmer; Nadyne Snyder, program assistant/editor; John Murphy, editor, and Barbara Graves illustrator, completed the 1979 roster. Fifteen collaborators from five universities, the Park Service and the Forest Service, assisted and three project advisors served in a review capacity.

Abstracts of all projects conducted in the nine years of operations are contained in the publication, which can be had by contacting Nadyne Snyder, College of Forest Resources, University of Washington NPS/CPSU, Seattle, WA 98195; (206) 543-6210 or FTS 392-6210.



## SUPERINTENDENTS' CORNER

The emphasis in this first issue of PPS is on the synergistic nature of the science/management process as it operates through the Cooperative Park Studies Unit concept. It seemed fitting then, that the first words from this corner should mirror the subject of CPSU's from a particular park superintendent's point of view.

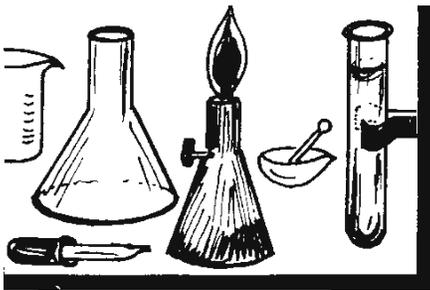
The item comes from Fort Vancouver National Historic Site, where decay was found in king and gate posts and in palisade pickets that had been pressure-treated with pentachlorophenol in mineral spirits. A wood preservation expert, Prof. Robert Graham of the Oregon State University faculty (made available through the DSU-CPSU connection) went to the park, determined the exact nature of the problem, and prescribed a volatile fungicide that would control the internal decay.

Surface decay, a more difficult case, requires further research, but interim control techniques have been recommended and Supt. James Thompson is satisfied that the "stitch in time" could add substantially to the life of these wood structures.

"Now we know how to prolong the life of the wood," he said, "and we know too that replacement today would cost at least 30 percent more than the original construction."

Jim recalled the help provided by University of Texas faculty and students on a contract basis to White Sands, NM where he was superintendent from 1973-78. "They helped us manage kit foxes and carrion consumers," he said, "and gave us priceless advice in dealings with the Army over placement of a trench for the White Sands Missile Range.

"Put me down as a believer," he concluded. "Research pays off!"



## C.P.S.U. Idea Celebrates 10th Birthday

The continuity of leadership provided by Don Field and Dean Bethel is reflected throughout the Western states in the continuing CPSU thrust: to find a flexible, adaptive model for providing scientific inquiry to a cluster of parks rather than a single park . . . to furnish an umbrella under which expertise from the University communities can be drawn upon for solutions . . . to offer wider access to new information in the face of new threats and promises within the National Park System.

For specific reactions from two superintendents, see the John Day Fossil Beds item on page 8 and the Superintendents' Corner on page 10.

The strong growth pattern demonstrated by CPSU's in the past decade is tempered by the historic instability of research organization within the Park Service, and NPS scientists are aware of the need to keep the program useful to the administrations of both the Service and the cooperative universities. Constant feedback is necessary if the constraints imposed by both parks and academia are to be well met. This publication is intended to provide one more arena for airing problems and savoring successes.

If you get to be 10 years old, presumably you're doing something right.

This year, the Cooperative Park Studies Unit idea – National Park research through university-based programs – is celebrating its 10th anniversary in the region where it was born – the Pacific Northwest, and the university dean who helped midwife the movement is throwing a birthday party.

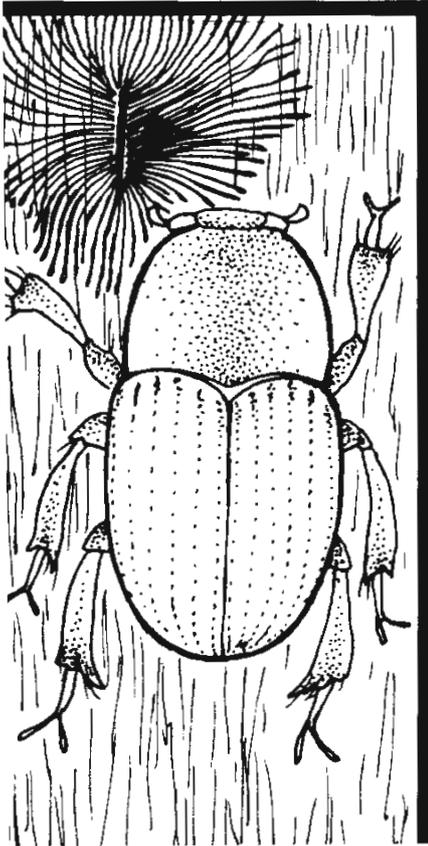
In 1970, armed with a paper signed by then Director George B. Hartzog, Jr., three NPS scientists in Seattle set up an interdisciplinary team that would look at sociological, botanical and zoological phases of changing conditions in NPS sites throughout the Pacific Northwest Region. They were Don Field, Garrett Smathers and Dick Weisbrod (sociologist, botanist and zoologist, respectively,) and the activating agreement was signed by Robert Linn, then NPS chief scientist, and James S. Bethel, dean of the College of Forest Resources at the University of Washington. James Agee, who succeeded Weisbrod, has provided the recent leadership in both botanical and zoological areas.

Dean Bethel, who is hosting the anniversary celebration, is at least as enthusiastic today as he was when the idea was a-borning. The program's growth to the present network of 35 units, operating out of universities all across the U.S., testifies to the rewards provided the various communities involved – scientific, university and park.

In the beginning, the University of Washington-based unit emphasized services to Olympic, North Cascades, Mount Rainier and Alaska. Then, in 1972, the University of Alaska unit was established; Oregon State University followed in 1975, and this year a unit opened at the University of Idaho.

The Western Region was quick to recognize and adopt a good thing, starting its own CPSU network in 1971 with a unit at the University of Nevada. This was followed in 1973 with units at the Universities of Hawaii and Arizona and in 1979 with the University of California at Davis. Last year the Western Region went all the way and decided that CPSU's would be the backbone of the Western Region's science organization. In a memo dated March 15, 1979, Bruce Kilgore, associate regional director for resource management and planning, described the need for "solid, professional scientific data to support management and at the same time a more flexible, cost-effective science program."

Howard Chapman, regional director, concurred, and the move was made.



breaks of moth activities. As the more severely defoliated trees die, remaining trees appear to benefit from increased nutrients, moisture and sunlight. The fallen needles and insect frass ("a mixture of excrement and partly digested needles") have been estimated to increase nitrogen and other nutrients to nearly 10 times the amount returned in normal litterfall.

Insect Ecologist Boyd Wickman of the Pacific Northwest Station's Forestry Sciences Laboratory in Corvallis, Oregon, has studied forest pests for 25 years and comments on the close interrelationships among all components of forest eco-systems and their shared thousands of years of evolution.

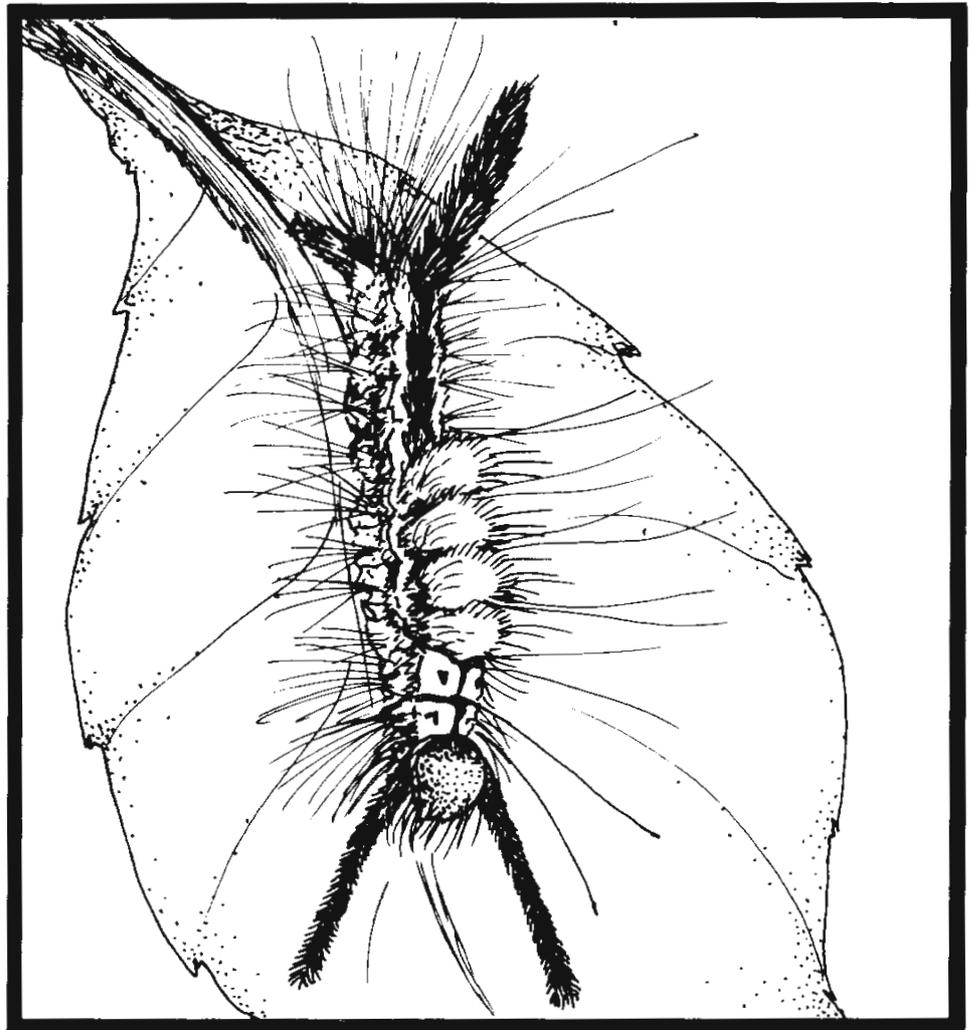
He suggests that insect defoliators play roles similar to that of the bark beetle in pine forest succession, and concludes that separating out the individual strands of process may prove impossible — that only an ecosystems approach will ever come close to giving a true picture.

Wickman then goes one step further and includes scientists and managers in his ecosystems view. "It will take years," he said, "to answer the many intriguing questions about the effects of defoliation on forest ecosystems," and he believes the job "can only be done by a succession of scientists working on plots protected by a succession of cooperating land managers."

## INFORMATION CROSSFILE

**FORESTRY RESEARCH WEST**, a report for land managers on recent developments in forestry research at the four western Experiment Stations of the Forest Service, U.S. Department of Agriculture, comes out four times a year and is full of information useful to both researchers and park managers. Add your name to their mailing list by writing *Forestry Research West*, U.S. Department of Agriculture, Forest Service, 240 West Prospect St., Fort Collins, CO 80526.

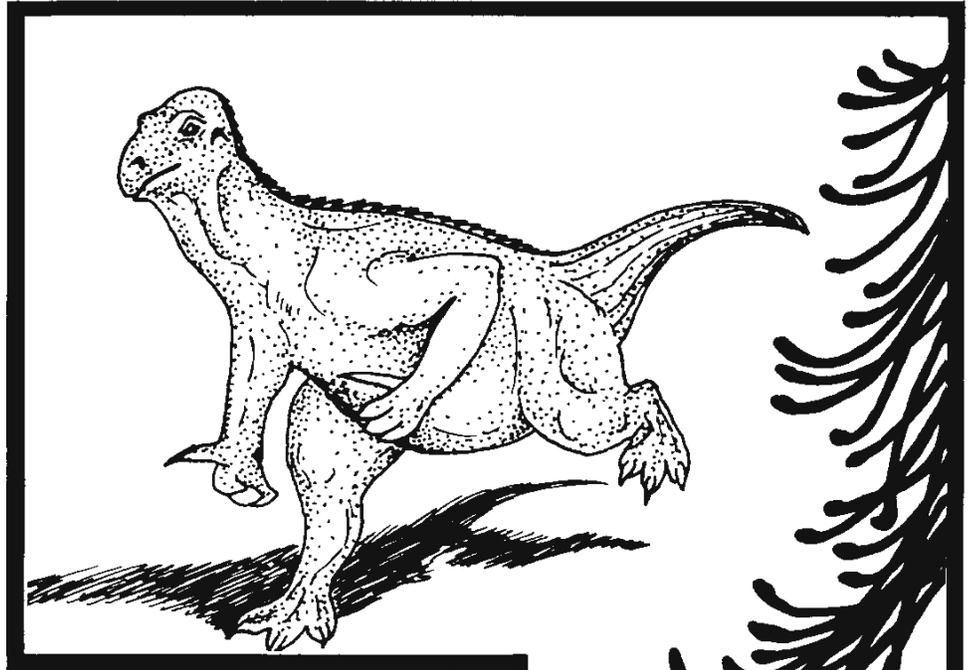
The August issue carries a piece describing the developing longterm picture of forest dynamics that is emerging from tussock moth research. It recounts evidence of enhanced growth following older out-



**11593**, is a monthly newsletter published by the U.S. Department of the Interior's Heritage Conservation and Recreation Service. Its content is information related to responsibilities of the Secretary of the Interior under Section 3, Executive Order 11593. Its pages are full of articles about preservation of America's heritage – citizen action, legislative thrusts, tourism, landscape and resource preservation, architectural history, archeology and a variety of initiatives for conservation in these fields. Much of the material is condensation of articles and books dealing in more detail with the subject matter. A staff of eight based in Washington, D.C., welcomes articles and suggestions. To contribute or to subscribe (it's free), write The Editors, 11593, Heritage Conservation and Recreation Service, U.S. Department of the Interior, Washington, D.C. 20243.

**SYNTHESIS** is a quarterly newsletter published by the University of Idaho Forest, Wildlife and Range Experiment Station, Moscow, Idaho 83843. The newsletter provides news of upcoming seminars and courses in the subject areas, capsules of research project findings, information about personnel opportunities and actions, and listings of current publications. Subscriptions may be had for the asking.

**WATER RESEARCH IN ACTION** is a bimonthly published by the Texas Water Resources Institute and reporting research from state water resources institutes and the Office of Water Research and Technology, U.S. Dept. of the Interior. It generally contains one full article (July/August 1980 featured



flood plain management, September/October focused on instream flow requirements) plus a descriptive roundup of new studies under various headings appropriate to the lead article. Thus, the flood plain management roundup dealt with studies under economics, legal and institutional, technology transfer, and technical. Instream flow's roundup described institutes in the areas of habitat modeling, habitat studies and flow patterns. To get on the mailing list, write Water Research in Action, Texas Water Resources Institute, College Station, TX 77843.

**DF** (Deutscherforschungsdienst), the German Research Service, carries in its Vol. XIX, No. 6 for 1980, news of the first find of large saurians in Germany – Iguanodon bones found in a "rock pocket" that is being kept under police guard and a secret (as to whereabouts) from the world. "Somewhere in North Germany," excavation is underway in the Sauerland rocks in the Devon formation – over 300 million years old. Parts of the pelvis, backbones, extremity bones and jaw bones have been discovered – impregnated with pyrite, an iron-sulphide mineral that rapidly decomposes in humid air, releasing sulphuric acid which destroys the bones. A special initial treatment has been developed in which wax is "sucked" into the bones, thus preventing air from entering and pyritic decomposition.

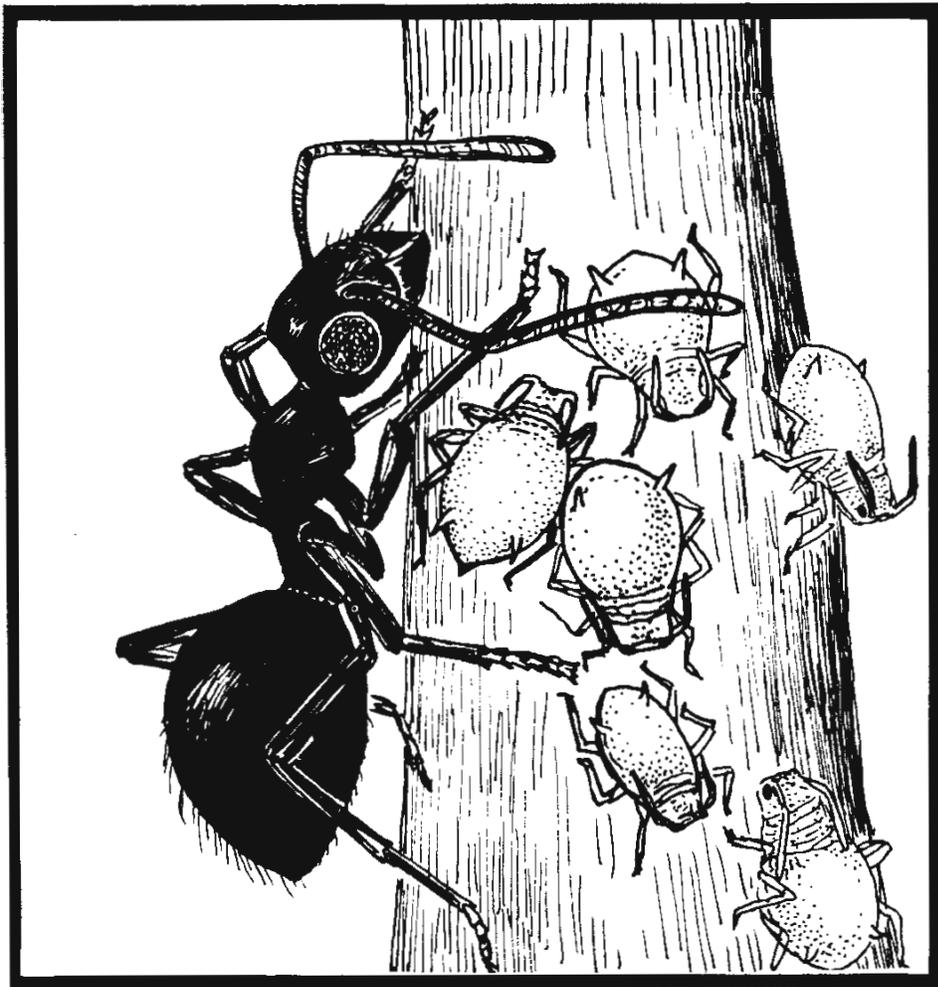


Also in **DF** comes news of Bremen's first environmental park. To quote "Inconspicuous pests such as caterpillars are no longer to be destroyed with chemicals – they are to be dealt with by the industrious forest-ant population. Lice assume their natural role once more. It is possible to observe the useful ants 'milking' these tiny creatures, profiting from it themselves but leaving enough for the several swarms of bees to be settled there. An unusual idyll which is to become the object of study. By 1984 the largest ecological station in the Federal Republic of Germany is to be set up in Bremen. It will form the centre-piece of Germany's first environmental park."

The article deals in detail with the site ("in the

charming Schönebecker Auetal – the meeting point of a major urban area and untouched nature") and the federal-wide pilot nature of the project. **DF** is published by the German Research Service, Ahrstrasse 45 (Wissenschaftszentrum), Postfach 20 50 06, D 5300 Bonn 2.

**FIRELAMP**, acronym for Fire and Land Management Planning, is a multi-resource model that simulates the effects of natural prescribed fires on the future production of resources such as timber, forage, wildlife, recreation and water. Begun in 1977 by scientists at the USFS Northern Forest Fire Laboratory in Missoula and scientists in the College of Forestry and Natural Resources at Colorado State University, **FLAMELAMP** is still in the development



stage. The program is being translated from a simulation development language (SIMCOMP) to standard FORTRAN language so it can be put on additional computers. Details can be found in the most recent (undated) issue of a "probably several times a year" publication called *Fire Effects and Use R & D Newsletter* from the USFS Intermountain Forest and Range Experiment Station in Missoula. For copies containing this and other fire R & D news, write the Station's Northern Forest Fire Laboratory, Drawer G, Missoula, MT 59806.

**CORPSPONDENT**, the Portland District U.S. Army Corps of Engineers' "unofficial biweekly offset publication" (P.O. Box 2946, Portland, OR 97208), devotes its Sept. 19, 1980 issue largely to limnological studies of Crater Lake. The article describes ongoing research and the progress reports being made available to the National Park Service to help with lake management. Doug Larson, Corps of Engineers limnologist, began his Crater Lake studies in 1967, as part of a study team from Oregon State University. Larson and Stan Geiger, senior aquatic biologist with Beak Consultants, Inc., working almost entirely with their own funds and time, are continuing the investigation of thermal, spectral, chemical and biological properties of the lake. So far they have found more than 100 species of phytoplankton (drifting plant life) distributed down to about 200 meters (850 feet). More on this subject in the next issue of *Pacific Park Science*.

# Sierra Bruins — Appealing Scourge

By David Graber, Research Scientist  
Sequoia and Kings Canyon NP's

Many a veteran camper remembers the way it used to be for bears in places like Yellowstone, Sequoia, or Yosemite National Parks. There were the dumps, often called "bear pits," and operated a little like the Roman coliseums. The Park Service thoughtfully provided bleacher seating for visitors, and a burly ranger supervised dumping the day's garbage and kept a semblance of peace among as many as a dozen or more bears. Visitors got an entertaining show while the bears got fat and maybe even happy.

All was not sweetness and light, however. Black bears, the "gentler" of our two species, were responsible for more than 60 injuries to Yosemite visitors one year; bold bears regularly had to be trapped and relocated, or simply dispatched with a bullet. But these were also the days before ecological sensitivity and lawsuits, and there were few complaints.

In many ways we have come light years since then. Natural features, including *Ursus americanus*, are no longer treated by the Park Service as spectacles, but rather as integral — and integrated —

elements of natural ecosystems. The dumps are long closed; Yellowstone's famous "bear jams" are no more, and the rare visitor who intentionally tempts a bear is slapped with a fine. Even the garbage cans have special bearproof tops. But to the intense frustration of resource managers and Park visitors alike, the smart, strong, sometimes scary bruins have resisted mightily a return to pre-park ways.

In the National Parks of California's Sierra Nevada — King's Canyon, Sequoia and Yosemite — biologists have been scrutinizing the ecology and behavior of black bears for seven years. One goal was to recommend refinements in bear and human management that can lead us closer to park bear populations that live as they did before Europeans arrived, as free as possible from influence by the millions of visitors. (Sequoia and Kings Canyon NP's constitute a World Biosphere Reserve, where unperturbed populations of plants and animals are perpetuated.)

From 1974 through 1978, as a graduate student at the University of California, I collected data on nearly 300 different bears in Yosemite. Park Service bear technicians and my own crew worked cooperatively to trap, dart and snare bears in campgrounds and backcountry areas. By using brightly colored vinyl ear flags and radio collars, I accumulated almost 2,000 "fixes" on my marked animals. Even visitors helped by noting the flag pattern of the bear that had helped himself to their food.

During the course of my five years in Yosemite, bear-proof tops were installed on garbage cans and dumpsters; bear-proof food lockers were supplied experimentally to one beleaguered campground;



**Radiotracking bear** sends Research Scientist Graber scrambling over Vernal Falls trail in Yosemite.



**Research Scientist Dave Graber** holds a tranquilized cub, captured at Tuolumne Meadows, Yosemite, for marking and measuring. "You bet he was tranquilized," says Graber. "Some of my worst injuries have come from trying to handle untranquilized cubs."

bear-resistant cables for suspending supplies were strung in the most trouble-prone backcountry campgrounds.

As if the Park Service efforts were not enough pressure on the bears, 1976 and 1977 saw one of the most severe droughts ever recorded for the Sierra Nevada.

It is expensive and time-consuming to collect data on solitary animals with low population densities (less than one for each 3 km<sup>2</sup> of good Sierran bear habitat) and long life spans (four individuals I "met" in Yosemite were more than 20 years old). I also learned, to my dismay, that I was starting too late to be getting good baseline information. The mobs of bears that marauded Yosemite Valley had mostly dissipated by 1975 with the new intensive "Human/Bear Management Program." That year marked Yosemite's nadir in bear incidents as well, with nearly a thousand reported.

But as the crisis appeared to fade in the campgrounds, park managers and rangers intensifying their survey of backcountry problems were shocked to find that hundreds, perhaps thousands of backpackers were having their food swiped by persistent, sophisticated ursines. Whether the backcountry problem was increasing dramatically or simply was being freshly revealed by better sampling was unclear.

Meanwhile, I found that some longstanding and reasonable assumptions about the connections between bears and human food were not supported by the mounting evidence. While very few bears were primarily dependent upon human foods, nearly all bears whose home ranges intersected with a campground or backpacking area were supplementing their diets from these sources of largesse.

It took a relatively modest quantity of concentrated, high protein camper food, combined with the bulk of low quality herbs and grasses, to transform a previously unusable high country area into good summer bear habitat. Human food – with some bizarre exceptions – does not seem to be physically bad for bears; indeed, Yosemite's population was breeding at close to its biological maximum rate and some females were going into the baby-making business at the tender age of three.

Increased food supplies seem to contribute to lowering the reproductive age by one full quarter (from four to three years). Lowering age is a more powerful factor for raising populations than increasing litter



*A mother black bear at Organization Campground in Yosemite shows her cubs (off camera) how to pull down coolers that are incorrectly hung. This mother and her three offspring consumed in one hour the food intended to feed 12 members of a Boy Scout troop for five days.*

sizes. When you start pumping out new generations in 3/4 of the time, the arithmetic implications for management are profound.

These bears were also the biggest anywhere, with adult males in the fall often exceeding 400 pounds – occasionally, 500. As individuals they were thriving, but as a population they were showing some severe perturbations from the natural order the Park Service was after.

By the time I finished my work in Yosemite it was apparent that even a small "leakage" of food from the human system to the bears' was enough to have a rattling ecological impact and to keep the level of "incidents" unacceptably high. Closing off that nutrient flow has been and continues to be the No. 1 item in bear management. Among other courses of action, capture and relocation was expensive and usually resulted in the bear's eventual return. Killing bears, like relocating them, introduced its own, possibly extreme, disturbance into bear society.

The work I am now doing as a research scientist in Sequoia and Kings Canyon National Parks is designed to answer some of the thorniest questions still plaguing managers. Using radio telemetry, I will be following the fate of a sample of relocated nuisance bears, to determine what becomes of the ones who do not return. Do they become established successfully in new areas, or do they die? From my tagging in Yosemite I found that young bears, especially males one and two years old, seem to disappear at an amazing rate. Again using radio telemetry, I will try to determine if these animals die or disperse. We may find that certain age and sex classes in bear populations can be relocated or even destroyed without markedly disturbing the remainder.

Finally, by closely monitoring sub-populations of bears in heavily and lightly visited areas of these Parks, I hope to learn more details of the extent of the changes we have wrought on bear ecology and behavior.

Together with the findings of bear biologists in other places, we may at last be able to tell managers what actions will enable bears and people to live together in reasonable harmony, and how to accomplish that goal in the least disruptive and most cost-effective manner. It won't come easily or cheaply; years of struggle with our treasured ursine adversaries and thousands of ruined vacations that continue as I write this have taught us there is no quick fix.

# Bear Bibliography Nears 6000 References In Searchable Form

By Fred Dean, Project Leader  
Biology and Resource Management

The bear bibliography project, supported by the National Park Service since 1976, is well along toward the arbitrarily selected "maintenance" level. The project is collecting references on bear biology and management into computer-searchable files.

Diane Tracy, Candy Anderson, and Fred Dean of the Alaska Cooperative Park Studies Unit's biology and resource management program, have been collecting, screening, verifying, and processing literature citations dealing with bear for more than four years.

Supported almost entirely by NPS funds, the project is a prime example of cooperation between several regional offices and the Washington Office. The Pacific Northwest Region has taken the lead, both in funding and in providing continuity, with critical support from Washington, Denver and San Francisco. The multiplicity of support reflects the Service-wide nature of bear management and preservation problems.

Recent stock-taking by project personnel indicated that over 5,600 references on the two species of greatest concern to National Park Service managers (brown or grizzly bears and black bears) are currently

on tapes in searchable form. Roughly 1,500 more citations have been added to the working files since last spring; these will be included with the searchable files as soon as practical. Biologists and bear managers from around the world are making use of the bibliographies, even in the current draft form. Printed copies are being sold at the cost of producing them (\$8.00 per species bibliography packet plus 15 percent handling, if carbon copies are acceptable); that includes the list of citations with keyword descriptors of the contents for those that have been indexed to date as well as an index and vocabulary lists which help in designing searches.

So far about 60 copies of the bibliographies have been requested, mostly by researchers and state and provincial management workers. National Park Service regional offices have distributed copies to many of the western "bear parks." The Alaska Cooperative Park Studies Unit is using an upgraded version of the U.S. Forest Service's FAMULUS computer programs to handle the processing and searching of the bibliographies. Since these programs are widely avail-

able, potential users may want to purchase tapes and do their own searching; however, to date most users have requested searches through the Alaska Cooperative Park Studies Unit. Several workers have concurred that even extensive searches costing between \$100 and \$200 have more than paid their way when balanced against the cost of time and salaries involved in doing the job manually.

The "maintenance" level mentioned above has been roughly set at having nearly all of the important brown and black bear references (both published and unpublished) on the files and perhaps somewhat over half of these read in detail for the assignment of keywords. The latter process varies from paper to paper, but in some cases as many as 40 descriptive terms are added to the citation to aid in information retrieval.

If you are interested in obtaining copies, having searches made, or simply learning more about the project, contact the Alaska Cooperative Park Studies Unit, 210 Irving Building, University of Alaska, Fairbanks 99701 (907/479-7672).



# PACIFIC PARK SCIENCE

NATIONAL PARK SERVICE  
U.S. DEPARTMENT OF THE INTERIOR

## FALL 1980



U.S. DEPARTMENT OF THE INTERIOR  
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## WASO Publications

Five scientific monographs and one occasional paper are in production from the Washington office, Division of Science and Technology, according to Napier Shelton, writer/editor in charge of the operation.

By the time this issue goes to press, advance copies should be out on SM #12, *Giant Sequoia Ecology: Fire and Reproduction* by Thomas Harvey, Howard Shellhammer and Ronald Stecker and on SM #13, *The Impact of Three Exotic Plant Species on a Potomac Island* by L. Kay Thomas Jr. SM #14, *The Grizzlies of Mount McKinley* by Adolph Murie will have gone to the printer, and two other SM's are in paste-up - *Ecology of the Carmen Mountains Whitetailed Deer* and *Social Behavior and Ecology of the Collared Peccary in Big Bend National Park*. The occasional paper (#6) deals with the climate of Yellowstone and Grand Teton National Parks and will go to the printer in December.

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### ON THE NEXT ISSUE COPY

The next issue will carry stories from Redwood (Stephen Viers on rehabilitation of cutover areas), from Olympic (John Aho and Bruce Moorhead on campsite backcountry rehabilitation) and from Crater Lake (several stories, ranging from limnology and lake monitoring to technology transfer).

Roger Contor and Aho will describe the reorganization at Olympic NP to bring scientific research more closely into the management scheme. And Napier Shelton and Gary Machlis will make separate reports on their recent (and separate) trips to China.

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