PARK SCIENCE

A RESOURCE MANAGEMENT BULLETIN

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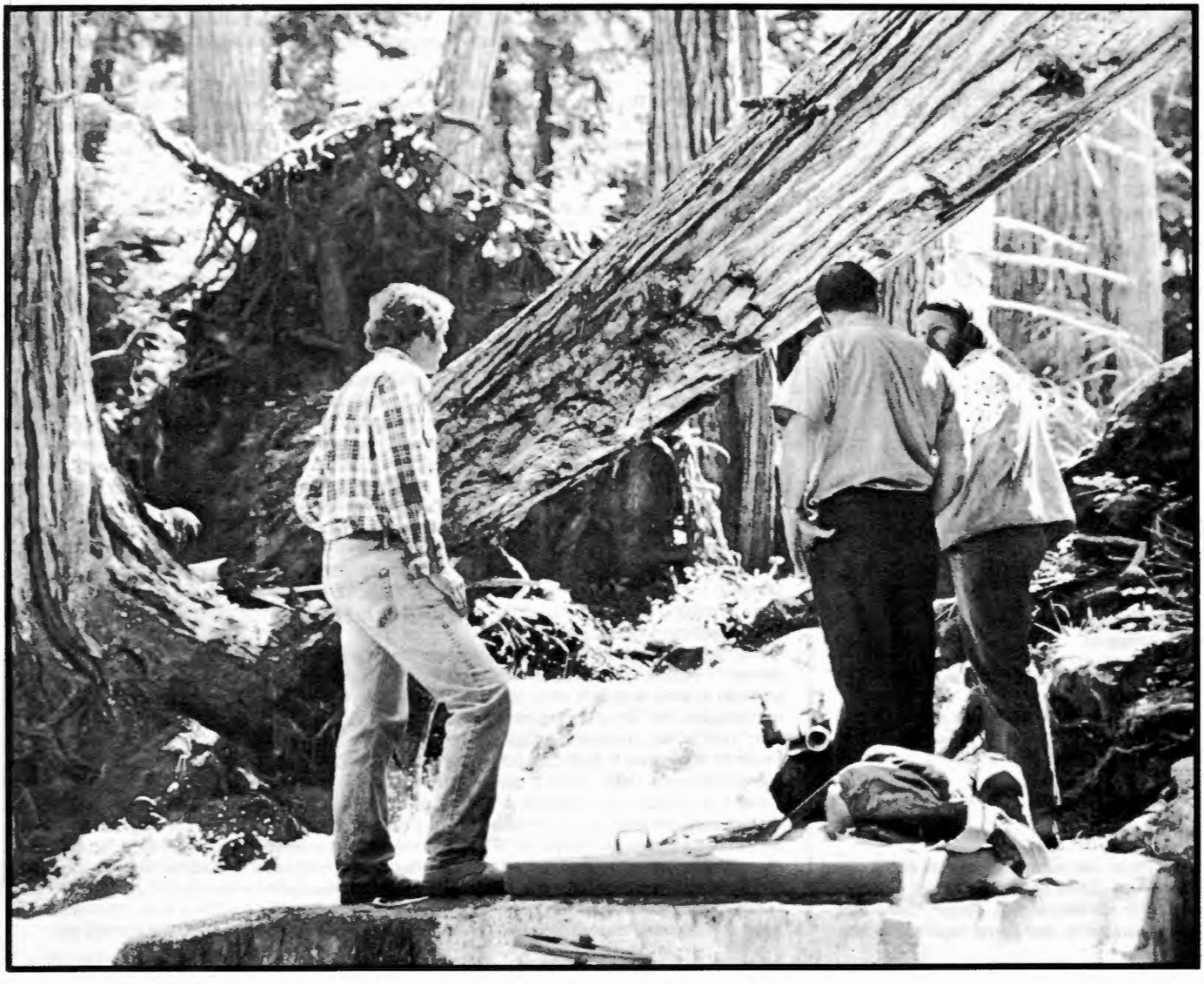

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NATIONAL PARK SERVICE

WINTER 1984

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

In This Issue

Cover Photo: *The water intake on Lake Creek, supplying Oregon Caves National Monument, is here inspected by Bill Weaver (left), Oregon Caves Supt. John Miele (center), and Danny Hagans. See story page 00.*

Editor's Note: The following paper was given on Dec. 3, 1981, at the Mather Training Center by Rick Smith, now the Asst. Supt. of Everglades National Park, as part of a Ranger training course on Natural Resource Management: Policies and Politics. Smith called his presentation "Some Non-Ecological Principles." On Oct. 10, 1983, at the Ranger Rendezvous in Las Vegas, Smith submitted his paper to Park Science *for consideration as "some thoughts from the superintendents' corner."*

By Rick Smith, Asst. Supt., Everglades NP

It is odd, considering what the National Park Service is supposed to stand for, that the position of advocacy for resources is many times a lonely stance. During my tenure as an instructor at Albright and my subsequent assignments in Washington and the Everglades with brief stops in Alaska and Fredericksburg, I have come in contact with numerous Park Service employees who seem to have made a decision that separates them from this position. These employees have pledged their loyalty to the National Park Service, not to the National Park System. For many of them, their careers come before the parks. They feel most comfortable, for example, when their performance is measured against standards which deal with personnel management, equal opportunity, or budget management. Conversely, they feel least comfortable when they have to stand up for the parks of the System — when they have to speak on behalf of the values for which the parks were established.

If there is one philosophy that I hope we all share here today, it is that our ultimate allegience must lie with the resources we were sworn to preserve and protect. I can think of no more awesome responsibility and, although it may sound a bit corny, no more sacred trust. These resources represent the natural and cultural heritage of our country.

To have a corps of people inside the Service who share this philosophy is particularly important now for a couple of reasons. The first is that urban America is rapidly closing in on the remaining natural areas of this nation, many of which are within the National Park System. These threats do not respect artificially established legislative boundaries. Increasingly, these activities pose threats to the natural resources of our parks. Not only are there more people all the time with the corresponding needs for residential development, energy, transportation, recreation and the like, but these services produce by-products and spin-offs which are not yet perfectly understood. What we *do* know is not very reassuring for those of us dedicated to the preservation of our park resources.

Moreover, the change of Administrations, has brought to pass a new way of perceiving the resources of our nation. While not wishing to argue the merits of this change, I would argue that those who share the philosophy we have been discussing must carefully monitor how the changes may affect the natural values of our parks. The principles that guide park management are the product of over a century of experience. During the evolution of these principles, many concepts, ideas, programs, and activities have been tested and either discarded or accepted, based upon their impacts on the parks.

We must guard against abrupt changes that have not stood the tests of investigation and trial. This is not to say, certainly, that new approaches are not worth trying. It is only to say that we know that many of the natural resources of our parks are extremely fragile. There appears to be an exceedingly small margin of error in their management. We must be vigilant that we do not exceed this margin while adapting to a new Administration.

Frederick Law Olmstead, whose idea was restated in Joseph Sak's provocative book *Mountains Without Handrails,* claimed that the value of national parks is that they exist outside of time and space. While in these sanctuaries, the visitor becomes aware of his or her relationship to the environment and, in our historical parks, to the past. It is not that our civilization is moving too fast, they argue; it's just that if there were no places such as national parks, we would have nothing against which to measure the change.

I suspect that if we queried natural resource managers across the System, the vast majority would agree that Olmstead and Sax's argument is an excellent base upon which to build a philosophy of natural resource management. To preserve and protect natural processes within parks has been the general policy of the Service since at least the publication of the Leopold Report.

Why, then, if we agree that this policy has merit, do we need a class such as the one we are sharing at this moment? I believe it is because our ability to preserve and protect natural processes within our parks is compromised at every level, both within and without the Service, by a series of political considerations. It is these considerations that I would like to explore with you today.

You have all had exposure to biological principles around which a park staff can build programs. I suggest a similar set of principles to guide us in our approach to the non-ecological factors that influence our resource management decisions. I have chosen to use the commercial fishing issue in Everglades as my example.

First, some background. Authorized in 1934 and established in 1947, Everglades NP was set aside to preserve the wilderness character of the Everglades. In one of the most directly worded pieces of legislation having to do with parks, the enabling act directs the NPS to permit no activities or developments which would detract from this character. The Committee Reports stress the importance of the Everglades for scientific research. Subsequent designations have reiterated this 1934 Act. In 1975, Everglades was named a Biosphere Reserve; in 1977 Class I airshed status was conferred on the park; in 1978 1.3 million of the park's 1.4 million acres were added to the National Wilderness Preservation System; and in 1979, the park was designated as a World Heritage site.

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A View From Redwood Creek: Learning By Doing

By Robert Belous

A discrete blend of summer fog, soil chemistry, mild maritime climate, and drenching winter rains has provided stable environs for California's coastal redwood forests for upwards of 20 million years, according to fossil evidence. But heavy timber harvests have destabilized a substantial portion of this landscape. Steep timbered slopes have been turned into oozing slides of top soil. And sediment-loaded streams now threaten remaining stands of old growth redwoods as well as spawning runs of salmon and steelhead trout. Today, side-by-side examples of eroding clearcuts and pristine redwood groves within Redwood National Park (RNP) serve as a proving ground for resource management techniques that could be of interest to troubled parklands nationwide, and beyond.

When Congress passed legislation in 1978 (P.L. 95-250) adding 48,000 acres of Redwood Creek basin to Redwood National Park, it included some of the tallest remaining trees, giants ranging from 400 to 800 years of age and rivaling our nation's capitol in height. The conservation goal, in part, was to add to the park as much of Redwood Creek watershed as a complete ecological unit as was attainable. But attainment fell short of aspiration.

The upper two-thirds of the watershed remained outside of park boundaries – and thus available for logging by private interests. Erosional outflow from these upstream lands now comprises the major source of impact to the park's redwood groves. And of the 48,000 acres added to the park, about 36,000 acres had been logged. Cutover lands included stark examples of unrestrained harvest practices (e.g., unlimited acreage cuts; no buffer strips; stream dumping of slash and soil) later corrected under California's exemplary Forest Practices Act of 1973. Results of old logging methods were brought into sharp focus by unusually severe storms in 1972 and 1975. Much of the raw landscape still has the look of an active war zone.

Today, where untreated, ditch-lined logging roads on steep, unstable slopes collect heavy surface runoff from the 80- to 100-inch winter rains. Chutes of water flow onto cutover slopes where average grades are 30 to 50 percent, and can exceed 70 percent. Deep gullies form and slopes fail. Earthflows, present under natural conditions, accelerate sharply. The active biotic layer of 10 to 20 inches in depth washes directly into streams. The basin's substrata of schist, sandstone and shale is often laid bare.

In Redwood Creek basin the annual erosion rate climbed to more than 8,000 tons of sediment per square mile by 1975 – up from an estimated natural annual erosion rate as low as 1,000 tons per square mile. Some tributaries carry 20 times their normal sediment load. Stream channels fill and force water flow over old banks, undermining streamside stands of Douglas fir in upstream areas, and threatening (by raising the water table) the downstream terraces where the world's tallest trees stand – presumed inviolate under NPS protection.

Yet the Congress's charge to the Park Service is clear: Rehabilitate clearcut areas within and upstream of the park, and reduce risk of damage to streamside areas adjacent to Redwood Creek. An appropriation of $33 million was authorized for the program, this to be expended over a 10-year period. Now nearing its midpoint, how has the program fared? To what degree will it succeed? Are midcourse adjustments planned? And when and how will the program phase down? Or, phase over?

***An unearthed redwood stump**, its 14-foot crown marking the level of an old logging road, is a measure of the recontouring needed to control erosion and stabilize a scarred landscape in Redwood Creek watershed. Park geologist Terry Spreiter directs operations with an eye toward relocating original stream channels that may carry 20 times their normal sediment load.*

While a watershed "rehab" plan was being designed (published April '81), a cadre of some 70 professionals, technicians and administrators was assembled. Immediate attention turned to accurate mapping and identifying hot spots where heavy erosional losses were imminent. From the outset it was damage control unadorned. "Proximity to the stream channels has been and is the alarm bell for stabilization control," according to Bill Weaver, the team's engineering geologist at the park's Arcata office. Steepness of terrain and soil types, Weaver points out, are also parallel considerations before committing money, manpower and machines to stem a mass wastage of soil.

Given the incremental nature of annual funding, only a limited number of actions are possible each year. And there are a bevy of efforts to keep in motion: e.g., stabilizing the worst of some 200-plus miles of logging roads; core drilling for landslide analysis; straw mulching for stabilization and regrowth; monitoring for results; experimental compost production; and review of timber harvest plans in the privately-owned 30,000-acre Park Protection Zone (PPZ) established by Congress upstream of the park's Redwood Creek boundary.

As the rehab program took shape it sorted out into three distinct efforts. One-fourth of the job relates to reviewing plans for timber harvest outside the park with an eye to sediment loads entering Redwood Creek. A second 25 percent of the team's effort is applied to refining the sediment budget equation for the watershed (a kind of pulsating model of inflow and outflow and storage cells that is tied to old logging outwash, vegetation recovery and the size and ferocity of winter rain storms). The last half of the job relates directly to erosion control, recontouring road scars, revegetation, mapping, monitoring; simply, keeping the soil on the slopes.

Aside from emergency actions, the top of the program's hit list has been the determination of the entire watershed's sediment budget. The effort is aimed at an area of 280 square miles surrounding Redwood Creek's 55 miles of mainstream flow. Geologist Mary Ann Madej (appropriately pronounced "May-Day") is responsible for coordinating this new technique for assessing how long the park's portion of the watershed will remain in an aggraded, or sediment-

***Aerial View** of Clear-Cut and Old Growth Redwood Forest Included in 1978 Park Expansion Area. Bulldozers, zig-zagging across hillslopes and steam channels on the former forest floor, created a "web" of trails as they skidded logs down to the lower road. The area was logged and burned in 1975-76. The area near the top of the photo was logged 10 years earlier and displays some revegetation. Post harvest erosion from such steep, highly disturbed logged lands in the park is being addressed by a unique watershed rehabilitation program. By 1983, all the logging roads in this area of the Bond Creek basin, as well as in many other regions of the park will have been obliterated and adjacent clear cuts treated to control or prevent erosion.*

swollen, state. Harvey Kelsey, a research geologist, uses comparative aerial photographs to ascertain the year in which landslides occurred and the nature of ground conditions at critical transition phases. Kelsey's original design for the project emerged from expertise gained through a doctoral research program in California's Van Duzen River watershed.

By applying the concept of compartments, and measuring streambed profiles at discrete locations, a predictive model has emerged. It describes for the first time the dimension and dynamics of the great glut of gravel associated with years of logging outwash that is now trying to work its way down Redwood Creek in annual rain-driven pulses. The material – unconsolidated Franciscan geology ranging from fine alluvial silt to cobbles the size of bowling balls – becomes lodged in varying compartments along the waterway.

Material in the active stream load can pass through the park in 10 years. Gravel bars and other semi-active loads (not mobilized with every rain storm) can take upwards of 15 years. Inactive sediment found in areas of 20 year old alder growth need major storm events to mobilize and thus can take over 100 years to pass through the park. Finally, sediments that have been lifted by extreme storm events onto alluvial terraces among old growth redwoods may remain in place for thousands of years. Meanwhile, new sediment continues to work its way into the system, though at a reduced rate. The sediment budget equation is complex and difficult to measure, but is now a working tool. For outflow data, the Redwood team contracts with U.S. Geological Survey. Their stream gaging techniques show amounts of material leaving the system in terms of bedload, plus suspended sediments that are flushed out to sea.

The famous Tall Trees Grove stands near the mouth of Tom McDonald Creek, a tributary of Redwood Creek. Five feet of aggraded material has built up there since 1964. The grove is now only about 15 feet above the stream bed instead of the 20 feet elevation of safety its trees once enjoyed. Redwood roots are comparatively shallow, from 5 to 8 feet deep, and any more sediment build-up could pose a threat to the big trees' root system. The unspoken question: Can the Tall Trees be saved? No answer yet.

The land use history of the entire basin has now been documented. "One thing we found," Madej said, "was that once the sediment gets into the creeks, it's basically a lost cause. It's too difficult and expensive to remove the excess material. The only effective remedy is to prevent more sediment from washing into the creek."

The exceedingly diverse character of the scarred landscape is beginning to emerge. "We now know how much sediment each type of erosion problem is contributing," Madej said. "We're ready to move into the predictive stage." During the November through March storm season NPS and USGS people go to the gaging stations and measure sediment flow during storm events. With these data a determination can be made as to which points of the basin are producing the most sediment and how quickly it's transported under various conditions of rainfall and stream flow. "Once we define the sediment transport relationship," Madej points out, "we can say with relative confidence that given *these* conditions, *this* will happen."

Field techniques also are evolving that spot serious transient conditions; say, a stream crossing or road with a high potential for washout; or worse, landslide. The locale is carefully mapped and a corrective prescription proposed. Review is done by an interdisciplinary team from the park's Resource Management and Technical Services divisions. A clearance survey for endangered species and cultural resources also is set in motion. The team closely screens the plan for the level of severity involved, efficient sequencing and proper engineering methods, achievability, and cost effectiveness. Given daily costs of $350 to $1,000 for earthmoving machinery on location, budget estimates are given monastic scrutiny.

If the plan passes muster, trucks, bulldozers and rehab teams move out to begin road fill removal, surface decompaction and, in sensitive areas, careful recontouring of slope profile. Straw mulch at 6,000 pounds per acre is distributed. Fir and redwood are planted along road alignments. In the case of streamsides, shrubs and trees are added – fast growing red alder (*Alnus rubra*) on the moist side of the drainage and coyote brush (*Baccharis pilularis*) on the dry side, these to stabilize soil and hasten recovery. Streams diverted years ago by road building are rerouted to natural channels. The treated area is then monitored for rehab success, and the results are used to streamline the next project. The program is self-correcting.

Monitoring already has resulted in beneficial adjustments in methodology. "In the early stages of erosion control our field efforts were predominantly labor intensive," recalls Lee Purkerson, Technical Services Chief. "And that's just what Congress intended as a step toward reemployment for timber industry personnel displaced from jobs when the park was expanded in 1978." But soon two problems were noted. Aside from mulching and planting, hand labor could never accomplish the major tasks. Sheer volume of soil and debris called for earthmoving strategies that far surpassed anything attainable by a hands-on labor force. Secondly, creating such a labor force did not prove a direct benefit to former timber workers with machine and mill operating skills. "The major emphasis was shifted from labor intensive to a mechanized operation," Purkerson said. "It's getting the job done and we're now employing more of the people Congress intended to reach in the first place."

Control of potentially injurious logging practices in the PPZ upstream of the park boundary is critical to protection of the park's aquatic and riparian resources along Redwood Creek. Geologist Danny Hagans and Bill Weaver are the key men for dealing with upstream land use activities. Although enforcement of state regulations and surveillance lies with the California Department of Forestry, the federal statutes of 1968 and 1978 establishing and expanding the park contain provisions for NPS involvement with upstream studies and review of proposed timber harvest plans. Congress recognized that continued monitoring of land-use practices upstream from the park was essential to provide adequate protection to park resources lower in the watershed.

"We've reviewed nearly 90 timber harvesting plans for the PPZ since 1978," Weaver said. "And above the PPZ we have reviewed about 30 plans that looked critical, ones that were along Redwood Creek stream banks, ones with known landslides, or ones involving new road construction." In all, about 10,000 acres adjacent to the park have been inspected for conformance.

Within park boundaries, estimates to date indicate that about 70-plus miles (out of over 200) of logging roads have been treated for stabilization. The rate of advance, though varying with problems en-

countered, averages 15 miles per year. Costs for worst-case road rehab can reach $40,000 per mile; average conditions yield costs of $25,000 down to $8,000 per mile. Most logging roads present a mix of conditions and costs. Generally, the approach is still on a "worst first" basis. Ridgeline roads, by contrast, pose little or no threat for erosion and so remain low in priority. In the interim, such roads can be utilized for fire suppression, rehab monitoring, and other management needs. Where natural recovery is feasible, the cost is zero.

The scheme is working, measurably. At the close of the 1983 season, approximately 32 percent, or 11,500 acres have been treated for rehab and stabilization, out of 36,000 acres of original clearcut. It also has been estimated that by 1983 erosion control efforts saved over 6 million cubic feet of sediment from washout – despite early stages of the program given to initial gearing up, adjustment of methods, team coordination. The volume of material is noteworthy. If spread 1½ feet deep over the bed of Redwood Creek, it would run for five miles; it would fill a procession of dump trucks lined end to end, stretching 150 miles.

In contrast to annual funding rates, progress in rehab of the park's redwood environment is not simply linear with time. New ground is being covered with each step. Case by case crises inevitably will alter schedules. And people with built-in experience in landslide control in 50 percent grade redwood terrain are not instantly hireable off the street. Today's experts did not begin as experts; there is a disproportionate time and funding nature to the program that is heavily front-end loaded.

Problems also have been increased in complexity by new insights into long-term weather patterns. Early stages of erosion control, for example, occurred during a long and unusual period of relative drought in redwood country. "There was a substantial gap in major storm events between 1975 and 1981," points out geologist Ron Sonnevil. Later storms of a 5-year-cycle proportion occurred during the winters of 1982 and 1983, causing slides and erosions at several road locations previously treated for rehab. Reworking those sites became necessary if future washouts were to be avoided. It was learn-by-doing. But the experience also evolved an improved technique and a better chance that a 20-year storm event (the last one occurred in 1975) can be weathered with little more than natural levels of sediment loss from treated sites. Rain events, their history and character, are now part of the lexicon for redwood rehab.

The program is recognized as one-of-a-kind. A symposium was held on redwood rehabilitation at Humboldt State University in California during August 1981, and attracted a wide array of participants from western states. Rehab sites have drawn visits by members of the Norwegian Parliament, and interest in the program has been expressed by forestry managers from Holland.

Importantly, the program evolves daily toward a permanent resource management scheme for the park. In a kind of inverse proportionality, the pure science and technical aspects transmute with time and experience into applied resource management functions. Despite setbacks and course corrections, the rehab progress curve since Congress's 1978 dictum is rising exponentially. More ground will be covered (literally) in less time as the last half of the program unfolds.

Also, spinoff benefits accrue whenever highly motivated teams of technical services and resource management people splice their various skills. For example, a plan is now underway for monitoring of air quality and pollution-sensitive lichen growth along the park's north boundary. Baseline data will indicate any intrusion on park environs by sulphur dioxide and other outfall associated with a proposed mining operation nearby and its burning of high sulphur coal.

Yet the sheer magnitude of the program and its ticking legislative clock calls for special management considerations. On the one hand, how to ensure within a shrinking time frame the goal of permanently curing man-caused erosion and restoring the cutover lands to a self-sustaining redwood forest ecosystem. And on the other hand, how to reasonably and efficiently evolve a highly specialized task force operation – with a once-in-an-era mission – into a basic part of the park's resource management scheme by the time the program winds down.

Supt. Douglas Warnock, a biologist by training

1(A) Before: Sept., 1980

Removal of the W-line logging road across Dolason Prairie Before/After

Complete recontouring of old logging roads is done only in areas where future visitor use is anticipated to be heavy or where park vistas would otherwise be impaired. Rehabilitation of 3,000 acres of prairie grasslands acquired in the 1978 expansion includes total outsloping of the roads, gully reshaping, protection of bare soils with straw mulch and revegetation with native grasses. Before (A) and after (B) photos show the dramatic results of restoration of the Dolason Prairie (photos taken in June, 1980 and June, 1981).

2(B) After: Oct. 1980

Students, Volunteers: Help or Headache?

Editor's Note: *The following article is offered as a set of guidelines equally useful to park scientists and park managers. As with most processes, an understanding of the forces at work, the benefits at stake, and the need for careful preconditioning and monitoring of the process will go far toward ensuring that all components of the process — science, management, and students — are net gainers.*

By Susan P. Bratton

If a senior researcher tells a park manager: "I'm sending a graduate student . . ." the researcher can expect a variety of responses. The manager may wince and moan: "Don't you remember that idiot from State U. who turned the jeep upside down in the creek," or the manager may smile and say, "Great, graduate students don't care if they get wet." Some park science programs have had a series of bad experiences using students and volunteers and others swear by them, believing it's a good, inexpensive way to get basic field work done.

Although there will always be some individuals who are hopeless in the field or who don't have enough drive to finish even simple tasks, most students are enthusiastic about their park experience, and produce good quality work. If only a few students are real problems, then why are some student projects productive while others aren't? The key is how students and volunteers are selected and how they are managed in the field.

First, in the case of volunteers, undergraduates and other inexperienced people, the longer they stay the more useful they become. It generally takes two or three weeks for someone to get adjusted to a park and a work routine. Students and volunteers should thus be recruited for continued sampling over long periods of time, such as three days every other week for a year or for work periods of two weeks or more. In this author's experience, a minimum of two months' commitment is best.

Sometimes large organized groups, with good leadership, can get specific chores done in shorter periods of time. A team of seven students from the University of Georgia censused the horses on Cumberland Island in four days in March 1983. This group was led by a Park Service scientist, and a work plan was ready for them when they arrived. The question, however, for effective science management is always, are these people staying long enough to make them worth the paper work and training? In terms of recruiting students, those who have solid science background or previous field experience, usually will be the faster learners. People who have recreational camping experience but no previous field science may adapt well to scientific field work; conversely, they may reject it as too much trouble and something that spoils their fun. An avid outdoors person, one who has worked on a serious field science project in the past, will almost always turn in an adequate performance when presented with a new challenge.

Once a particular school has sent a few good students, it is worthwhile to continue to recruit from that source. On the other hand, mixing students from more than one institution is usually healthy and can result in added benefits.

A second area where good supervision can improve performance is in briefing the students. Most "green" field researchers don't know the first thing about park policy. They may, in fact, have some dangerously false impressions. A good briefing should cover four areas:

(1) What is the student expected to do on the job or what is the expected final product? The research supervisor should conduct this discussion.

(2) What are the park rules concerning on-the-job issues, such as vehicles, road use, locked gates, off-trail camping, etc. Often someone new in a park will find all the GSA regulations, the equipment check out forms, etc., a maze of bureaucracy. Researchers who use firearms, traps, tranquilizers, etc., need to check them in through the chief ranger or the resources manager. Students need an explanation of why they should or should not do something. This will help them to remember the rules and to make better decisions in questionable cases.

(3) What are the social rules and the local housing policies. Many graduate students come directly from a university environment where "anything goes." Students are usually not accustomed to thinking of personal behavior in terms of public or park regulations. Rules about alcohol use, pets and guests at park housing need to be clearly explained. If students are housed in bunk space "no guests" is the best rule. A sound general policy is to warn students that they will be asked to leave if they break state or federal laws or regulations. The possession or use of controlled substances and illegal specimen collecting within the park merit special attention. Many students are naive about NPS's role as a law enforcement agency. Frequently they believe that participation in park science programs allows them to collect whatever they wish and spend part of their spare time indulging in personal natural history interests. Very few students, however, will risk terminating their park stay by picking up a few lichens, or capturing a lizard or two if they know it's against the regulations. Nude bathing presents a substantial temptation in some parks. Again, an explanation of the park's public relation problems and a firm "no" will help to discourage students from getting into trouble. The park staffer or scientist who does the briefing should try to make the student feel like a member of a working team rather than a kid receiving a parental lecture. A student or volunteer who feels responsible and useful will do a more professional job. A few minor infractions and

Learning By Doing (Continued)

and a veteran of complex resource problems during his tenure in the Alaska Region, is keenly sensitive to the management value of scientific expertise and data. "The intense work during the past five years on this park's primary resource – the redwoods – has given us an in-depth information base that well could be the envy of any park in the system," he said. "It's given us the capacity to gage even the subtlest differences between an undisturbed redwood forest and those heavily impacted areas Congress has told us to restore. And it's providing ways to close that environment gap."

Yet it is vitally important, Warnock points out, that we keep in clear focus the mission and nature of the rehab program. The landscape and habitat manipulations inherent to this program comprise a radical departure from the basic preservation and protection mission of the Park Service. To be sure, such a departure is justifiable by its final goal of restoring to the greatest degree possible a self-sustaining redwood forest within a national park. But as the program succeeds, emphasis and organization must inevitably shift.

"I've called for an assessment of all that has been accomplished thus far, so we can plot the most productive course over the next five years," Warnock said. "We're faced with very real limits of time and money, and we certainly don't want to discover down the road that a key link has somehow been left out of the effort. Ideally, as we erase man's impact on the redwoods we also reorient the park staff from one geared to rehabilitation to one able properly to manage and protect the renewing forest when the time and money run out. If we do it right, stage by stage, there should be no great or abrupt change on the last day of the last year."

Belous is Management Assistant at Redwood NP. The final installment of this article will appear in the SPRING issue.

A volunteer in the park, *Bill Querin helps with a feral horse habitat utilization study by counting scat in the dunes and marshes on Cumberland Island. Querin has a degree in wildlife management and worked in the park for over six months on various field projects.*

stupid mistakes are to be expected, but any student who breaks the "major rules" or shows clear disregard for NPS policies should be asked to leave as soon as possible.

(4) Who should a student go to if problems arise? They also should know what to do in case of emergency. Students need contact persons to provide assistance and advice.

Third, a careful judgment should be made as to which students are capable of working with little or no supervision. Undergraduate students are best used as assistants to more experienced people. Older students often can work independently but usually need someone who "knows the ropes" to break them in. Many park graduate research projects have failed because the students encountered logistic difficulties right at the onset and never overcame them. Park staff should expect research supervisors, including university professors, to check on their students occasionally.

Since the job market is tight these days, very few graduate students will "vacation" while they are supposed to be working. Most are, in fact, very industrious and put substantial spare time into their projects. A park manager must, however, learn to recognize the difference between an odd schedule, such as staying up all night to tag sea turtles, and "playing around." An occasional on the spot project review, and a look at the data being collected will help to sort out students who are non-productive.

Fourth, a manager can prevent problems by immediate and direct communication with the students. If a student has been driving on a closed road, neglected to fill a gas tank, or left dishes in the sink, the problem should be mentioned to the student as soon as is convenient. Many chronic student "problems" are really the result of poor communication. Unless someone has explained the rules to the students, don't assume they know them. Expect to have to provide an occasional reminder, particularly if there is frequent "turn over" of students and volunteers.

Fifth, a manager should be cautious when letting students take data from unfinished projects away from the park or a university cooperative unit. A student may suddenly take a permanent job, get married, or just go rambling, and never finish his/her write up. If a student wants to complete the paper at some distant location, make certain s/he leave a copy of the data, or better yet, a rough draft of a project report. For government funded projects, put a final due date on the project report. Then if the student doesn't finish, the park is free to get someone else to do the write up.

Sixth, before assigning a task to a graduate student, be certain it is a suitable project. Is it appropriate for thesis work? Can the park wait till the thesis is completed? Does the student's major advisor really understand what NPS needs? Graduate students rarely finish in less than a year and two to three years is more typical. Thesis formats may not be suitable for reports to park management. Matters such as report structure and completion date need to be discussed at the beginning of a project, not after the work is long overdue or the student has presented the park with an unsatisfactory product.

Finally, the manager should recognize a well run student program has numerous benefits. Students can supply very specific expertise for short periods of time. They may have external (non-NPS) funding. They need only stay in the park as long as data gathering is in progress, and can be terminated easily at the end of a project. Well supervised, students are inexpensive. Graduate students have a stake in the thesis past any immediate financial compensation, and will often put a tremendous effort into their work. Once a student program is established and running well, it can usually be continued with a minimal management input and a maximum scientific output for as long as the park needs the help.

Bratton is an NPS Research Scientist stationed at the University of Georgia, Institute of Ecology.

letters

To the Editor:

Your article on "pulse studies" (Fall 1983 issue) made me think of T.C. Chamberlin's classic paper "The Method of Multiple of Multiple Working Hypotheses." It first appeared in the *Journal of Geology*, Vol. V (1897), pp. 837-48, under the heading "Studies for Students." It was repeated in the *Journal of Geology*, Feb-Mar 1931. Chamberlin read a paper on the subject before the Society of Western Naturalists in 1892. I like the connection and share it with you for what it's worth.

"In developing the multiple hypotheses, the effort is to bring up into view every rational explanation of the phenomenon in hand and to develop every tenable hypothesis relative to its nature, cause, or origin, and to give to all of these as impartially as possible a working form and a due place in the investigation. The investigator thus becomes the parent of a family of hypotheses; and by his parental relations to all is morally forbidden to fasten his affections unduly upon any one. (pp. 160-161).

"In practice, it is not always possible to give all hypotheses like places, nor does the method contemplate precisely equable treatment. In forming specific plans for field, office, or laboratory work, it may often be necessary to follow the lines of inquiry suggested by some one hypothesis rather than those of another. The favored hypothesis may derive some advantage therefrom or go to an earlier death, as the case may be, but this is rather a matter of executive detail than of principle.

"A special merit of the use of a full staff of hypotheses coordinately is that in the very nature of the case it invites thoroughness. (pp. 162-163)"

I have always loved and respected these words of wisdom (and wish I paid more attention to them). They, and the "pulse" studies, smack of comprehensive critical rationalism (CCR), the contention that "all one's beliefs should be open to criticism." For William Bartley *(The Retreat to Commitment)*, "the rationality of a belief will be related to its success in weathering criticism."

Hope you like Professor Chamberlin. I like the beat of a pulsing science.

Edward Hessler, Executive Director
Minnesota Environmental Sciences Foundation, Inc.
St. Paul, Minn.

To the Editor:

Enclosed is an article from a recent *National Wildlife* on whitetail deer. They are becoming incredibly prolific in the East. Just today there were articles in the *New York Times* about the inability of Maine hunters to keep up with the exploding population, and on the need to hunt deer in a reserve here in Massachusetts. Is this going on elsewhere?

The article on deer in Shenandoah in your last issue touched on it, but I wonder if they won't find themselves so overwhelmed with deer down there in a few years that sophisticated management will have to yield to old-fashioned thinning.

Another interesting thing going on out here is the habituation of deer to civilization. Ditto for raccoons, fox, possums and lots of other small game. All seem to be adapting rapidly to the suburban/urban environment. Is this going on in other parks too, or am I just hallu-cinating?

I found the fall issue of *Park Science* most interesting reading. I'm intrigued by the "pulse" approach to resource management, which is so thoroughly enlightened that it's hard to believe it can occur in a bureaucracy. It's reminiscent of the Wetherill Mesa project that took place at Mesa Verde in the 60s, where scientists from about 35 disciplines analyzed all the data available from one community. The cross pollination that occurred among them seems akin to what the pulse folks have had in their evening sessions. Why can't we do more managing that way? If we could get all the interpreters, law enforcement types and resource managers from a park to sit down and talk shop around a campfire, the result would be discovery of shared ideas, growth of consensus, and a more positive approach to park operations. Albright should have a course entitled "Holistic Management." Ah well, at any rate, I liked the article. The vulture piece came out nicely too. Godspeed,

Bill Halainen, Editor
NPS Ranger Newsletter

> The Halainen letter included an article "Swamped with Deer" by Sam Iker from a recent issue of *National Wildlife* magazine. It describes the staggering explosion of deer population in U.S. urban areas, and then refers to a "forthcoming work" by Wildlife Ecologist Aaron Moen on the biology and management of white-tailed deer.
>
> "Moen's work," writes Iker, "constitutes perhaps the cutting edge of revolutionary new management techniques that will allow authorities to balance deer populations with available habitat and thus maintain healthy, stable herds. Key to his approach is the enormous data-handling capability of modern computers. His goal . . . 'is to put this art of deer management on such a sophisticated, high level of understanding and analysis that it'll stand up in any court of law — in terms of recommendations of what should be done, and can be done.'"
>
> Twenty years of research has enabled Moen to develop complex ratios and formulas covering everything from a herd's sex/age structure and metabolic cycles to the amount of metabolic forage energy contained in its habitat. A manager will be able to feed readily obtainable information into the computer and "by solving for the unknown" (as Moen puts it) a wide variety of critical answers can be obtained.

Failed Logging Road Interrupts Water Supply

A massive mudslide – up to 1,000 cubic yards of debris – starting from a logging road constructed by the U.S. Forest Service, in December 1981 plunged down an unstable slope above the Lake Creek intake for Oregon Caves National Monument's water supply, causing two episodes of excessive turbidity.

Redwood National Park came to the aid of Oregon Caves NM Supt. John Miele in the summer of 1982, sending Danny Hagans, geologist, and Bill Weaver, engineering geologist, to make a field inspection. The USFS subsequently implemented two of the nine NPS recommendations for corrective actions.

On May 23, 1983, a second high turbidity episode occurred, and on June 8, Weaver and Hagans again were loaned to the Monument to try to determine the cause. The photos and captions shown here describe the state of the slope and the water supply as of June 1983. The 1983 landslide and mudflow was caused, or strongly influenced, according to Hagans and Weaver, by diverted streamflow along the 4045D logging road.

A September 1983 memo from Redwood Asst. Supt. Donald M. Spalding to Supt. Miele, in part describes the mechanics of the problem:

"The accumulation of 1981 landslide debris on the 4045D road currently diverts streamflow to the north along the road for about 50 feet, where it enters 6-inch to 1-foot high scarps along the fill portion of the road prism. The new landslide is approximately 100 feet downslope from the scarps. Slopes within this area are extremely wet and naturally characterized by abundant Willow vegetation. Soils exposed in the crown and lateral landslide scarps are 10 to 15 feet deep and consist of primarily coarse sand derived from decomposed granitic bedrock. The addition of water to an already wet slope underlain by relatively cohesiveless materials apparently elevated pore pressures in the slope and led to the landslide and mudflow. This condition coupled with the existing lack of lateral hillslope support along the 1981 debris torrent track will continue to pose a high risk of future landsliding and, presumably, high turbidity in Lake Creek."

Supt. Miele reported to the Pacific Northwest Region on Oct. 13, 1983, that he and Resource Asst. Don McClennan of the USFS had conducted an Oct. 12 inspection of the site . . . that McClennan recognized the need to correct the stream diversion at the 4045D road crossing, and that this would be accomplished "prior to the onset of winter." McClennan agreed that catch basin structures Nos. 2 and 3 would be strengthened, but indicated that the stored sediments would not be cleaned out.

If excessive turbidity recurs this winter, Miele said, "we should reevaluate the situation and, if necessary, consider building a new permanent water intake upstream."

***The lowest** sediment storage structure installed by Forest Service personnel was this check dam made of chain-link fence and a filter fabric. The dam, (#1) built next to a large windfall log, collected and stored sediment through much of the 1982-83 winter after which the channel changed course (braided), leading to a lowering of the baseland. Approximately one half to one third of the stored sediment was eroded and transported downslope.*

***The next higher dam,** (#2), built by the Forest Service, functioned well until May 1983 when a rotational slide occurred, resulting in a mudflow down the channel and causing failure of check dams Nos. 2 and 3 (see next photo). The No. 2 dam currently has no available future storage, so it will only route sediment through or over the dam. Dam No. 2 has the potential of failing in the same manner as Dam No. 1 and transporting stored sediment toward Lake Creek.*

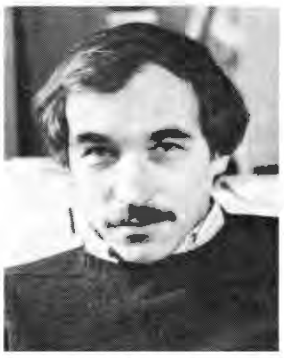
The view downstream *with Check Dam No. 3 in the foreground and No. 2 in the distance. Dam No. 3 also has failed as a result of the landslide and mudflow above. The same potentials for failure exist here as exist at Check Dam #2.*

Landslide slump block *and crown scarps on a very wet slope, which resulted in the mudflow of May 1983 that caused high turbidity values in Lake Creek and probably breached Check Dams 2 and 3. Cause of the slide was diverted streamflow along the 4045D road. USFS personnel have subsequently inspected the site and recognized the need to correct the drainage problem.*

Looking downslope *at Check Dam #4 on USFS 4045D road with wet slope and May 1983 slide in the distance. Dam #4 stored no sediment and basically no material was transported out of the upslope scar from the December 1981 slide. Streamflow out of the old slide scar is diverted by road to the right in the photo, only to cross the road and travel downslope, causing increased soil saturation in the vicinity of the new slide.*

regional highlights

Spotlight on A Region: North Atlantic



Mike Soukup

On Oct. 1, 1983, Dr. Michael Soukup assumed the position of Chief Scientist for the North Atlantic Region. Mike, an aquatic management biologist, has served as Deputy Regional Chief Scientist for the past four years. He takes over for Dr. Paul Buckley who leaves to become first Director of the Cooperative Park Studies Unit at Rutgers University, New Brunswick, NJ.

A variety of field research projects were conducted this past summer in North Atlantic Regional parks. Researchers from the University of Main and College of the Atlantic (Bar Harbor, ME) continued field work on the effects of acid rain on water resources in Acadia NP. At Fire Island National Seashore, Dr. William Patterson (University of Massachusetts, Amherst) working under a cooperative agreement with the US Forest Service, studied fire ecology and determined the Island's fire history. This completes a series of fire history studies at ACAD, CACO, and FIIS which have been initiated and coordinated by Mary Foley, Air Quality Specialist. These studies will provide each park with the basis for fire management plans.

Bill Patterson, with funding provided by the Interdisciplinary Science Team initiative, also led an investigation of the vegetative and land-use history of the William Floyd Estate. The team included Dr. Mark Sayre (Wildlife Biologist, U/Mass., Amherst) who evaluated the present and historical trends in wildlife habitat, Dr. Steve Kesselman (Historian and the Unit Manager) and James Clark, a University of Massachusetts palynologist.

Dr. Howard Ginsburg (Stonybrook University) conducted research on mosquito population dynamics, with emphasis on their migratory capabilities. Dr. Alan MacIntosh and graduate student Mark Sprenger (Rutgers University) surveyed water resources at Fire Island National Seashore to determine the level of water quality problems. In addition, as an in-house project with the Fire Island NS staff, a deer census was initiated.

Ann Lewis, a forest ecologist, completed a vegetation inventory for the FDR National Historic Site. Researchers from Associated Ecologists, Inc. and the County College of Morris investigated water quality and aquatic organism distribution at Morristown National Historical Park. At Gateway National Recreation Area, Dr. Raul Cardenas (Polytechnic Institute of New York) completed his field season evaluation coastal water quality and the present park monitoring effort. Professors Bill Harris and Peter Franz (Brooklyn College) finished their field work on benthos population distributions in the Jamaica Bay (GATE).

Rutgers University completed two coastal geomorphology projects: (1) the development of an aeolian sediment budget for the south shore of Long Island barrier islands from Fire Island to Montauk Point and, (2) monitoring of sediment dynamics accompanying the beach nourishment project at Sandy Hook Unit (GATE). NARO's Coastal Geomorphologist, Dr. James Allen continues to be involved in shoreline studies at Gateway NRA and Fire Island NS plus paleogeographic reconstructions through vibracoring analysis at Sandy Hook (GATE), Cape Cod National Seashore, and Saugus Iron Works National Historic Site.

Bob Johnson (a student at the University of Lowell) has provided analytical determinations for our in-house water quality investigations (mosquito ditching impacts, Herring River, (CACO), Marshall Brook (ACAD), and Saint-Gaudens National Historic Site) under a no-cost cooperative agreement with EPA's Lexington Laboratory.

Copies of the final reports will be available at the conclusion of these projects from the Office of Scientific Studies, North Atlantic Region, National Park Service.

Resource Management and Visitor Protection within the Division of Management and Operations has two new staff appointments. Len Bobinchock is the Resource and Visitor Protection Specialist and Nora Mitchell is the Resource Management Specialist. They will be developing new initiatives for the NAR Resource Management Program in close cooperation with the Office of Scientific Studies.

Southeast Region

The South Florida Research Center at Everglades NP has the following publications available through the National Technical Information Service, U.S. Department of Commerce, 5285 Port Royal Road, Springfield, VA 22161:

SFRC-83/04 Fire effects on flowering and fruiting patterns of understory plants in pinelands of Everglades National Park by Lance Gunderson, Dale Taylor, and Jim Craig.

SFRC-83/05 The Vegetation of Long Pine Key, Everglades National Park by Ingrid Olmsted, William B. Robertson, Jr., Jill Johnson, and Oron L. Bass, Jr.

SFRC-83/06 Mowry Canal (C-103): Water Quality and Discharge into Biscayne Bay, Florida, 1975-1981 by Daniel J. Scheidt and Mark Flora.

* * *

The Northern Gulf of Mexico Estuaries and Barrier Islands Research Conference was held in Biloxi, Miss., on June 13-14, 1983. Sponsored by NPS, Mississippi Bureau of Marine Resources, Gulf Coast Research Laboratory, and the Mississippi Cooperative Extension Service, the Conference attracted a large multidisciplinary audience. Session topics included barrier islands, coastal ecosystem resource and management, water resources, fish and shellfish resources, energy exploration and development (particularly off the Gulf coast outer continental shelf), oceanography, environmental assessment, and resource management issues.

Participants were from the U.S. Corps of Engineers, Minerals Management Service, Shell Oil Company, U.S. Fish and Wildlife Service, the Southern Natural Gas Company, National Aeronautics and Space Administration, National Marine Fisheries Service, Barry A. Vittor and Associates, Inc., National Park Service, the Gulf Coast Research Laboratory, Louisiana State University, University of Southern Mississippi, University of Mississippi, University of South Alabama, University of Alabama at Birmingham, the Marine Environmental Sciences Consortium, Aeronautical Research Associates of Princeton, Inc., Mississippi State University, and the Mississippi Department of Wildlife Conservation.

Steve Shabica, then NPS research oceanographer at Gulf Islands National Seashore and now at Biscayne NP, served as conference chair.

* * *

Paul W. Rose and Peter C. Rosendahl of the NPS South Florida Research Center in Everglades NP, are co-authors of "Classification of Landsat Data for Hydrologic Application, Everglades National Park," the featured article in the April 1983 issue of *Photogrammetric Engineering and Remote Sensing*, Journal of the American Society of Photogrammetry.

Digital image processing techniques were used to analyze multi-gemporal Landsat data (1972-79) of the 245,427 acre Shark River Slough at Everglades. The research defined the margins of the slough, both spatially and temporally, for various hydrologic conditions. Field data, aerial photography, and a "supervised" interactive image analysis procedure were combined to map the slough's margins. It was determined that indundation of the slough varied from a minimum of 90,402 acres to a maximum of 245,427 acres. This technique provided insight into relationships between water deliveries to Everglades NP and the interaction of sheet surface water movement through the slough.

Copies of the article are available from Rose, at Santa Monica Mountains NRA, 22900 Ventura Blvd., Woodland Hills, CA 91364. The research was in conjunction with the hydrology program at the South Florida Research Center at Everglades NP and was a cooperative effort with the Remote Sensing Division at the NPS Denver Service Center and the EROS Data Center, Sioux Falls, SD. It was completed just prior to Rose's transfer to Santa Monica Mountains NRA.

Western Region

From Gary Davis, marine research biologist at Channel Islands NP, comes the xerox of an abstract, in Russian, of a recent paper Davis wrote for the *Bulletin of Marine Science*. The paper was translated into Russian and the abstract published in the USSR.

Davis delivered, on Nov. 5, 1983, at the Third International Artificial Reef Conference in Biscayne NP, Florida, a paper describing the effective mitigation of marina construction impacts on lobsters in the Florida park. The paper will be published in the *Bulletin of Marine Science*.

Wrote Davis: "I made useful new contacts with marine scientists from Israel, Australia, and the Philippines regarding the role of parks and sanctuaries in managing marine resources and fisheries. I was told by a representative of the Florida Department of Natural Resources that renewal of the Biscayne Bay lobster sanctuary by the State of Florida was proceeding smoothly, and should be accomplished without difficulty. The conference was also an opportunity to demonstrate to the Pacific Coast scientific community the high quality of marine research the National Park Service supports. It was one of the best conferences I have attended."

* * *

Dave Parsons, research scientist at Sequoia and Kings Canyon NPs, is the author of "Wilderness Protection: An Example from the Southern Sierra Nevada, USA," published in the Spring 1983 issue of *Environmental Conservation*. "The need to take an active hand in assuring the preservation of naturally functioning communities, even within legally protected areas," he writes, "presents one of this era's greatest challenges to land managers." The article is a case study of the Rae Lakes Basin area in Kings Canyon NP.

* * *

Word comes from Kheryn Klubnikin, resource manager at Santa Monica Mountains NRA, about the park's Science Working Group. Klubnikin said she realized in 1982 that no one knew what scientific work had been done or was on-going at the park and it occurred to her that a survey would reveal the extent of past and current research, the level of interest among southern California scientists, and the potential "pool" of expertise on which the park might draw in times of need.

Of 1,000 questionnaires she sent out, Klubnikin received 210 back, showing a high level of interest in the area. About 72 on-going research projects were revealed, providing the basis for the first Superintendent's Annual Research Report, and a large number of classes were found to be using the mountains for field studies. Out of this interest began to grow the *ad hoc* Working Group, with impetus from the Park's Advisory Commission, which sees the Group as a way of bringing well-known experts into the Resource Management planning process, especially in the design of projects.

* * *

"The Ecology and Management of the Mineral King Deer Herd" is the title of a study by D.C. Cornett, W.M. Longhurst, R.E. Hafenfeld, T.P. Hemker, and W.A. Williams, published by the Cooperative NP Resources Studies Unit at U/Cal, Davis as Technical Report #14. Field work from 1976 to 1978 defined the ecology of the herd, its history, population size, food habits, seasonal movements, mortality factor, range condition and boundaries, and use of distinct habitat types. Observations also were made of deer behavior relative to human activity in fawning areas on summer range. Land ownership (a mixture of private and public land administered by BLM), herd biology, and range vegetation were considered in order to develop management recommendations for the herd.

Alaska Region

From John Dalle-Molle at Denali NP comes word of an annotated bibliography of human/wildlife interactions, by Stephen Boyle and Fred Samson. The U.S. Fish and Wildlife Service Report (No. 252) contains 536 annotated citations and keywords, author, species, and geographic indexes. It can be obtained from USFWS, Editorial Office, Aylesworth Hall, CSU, Fort Collins, CO 80523.

* * *

NPS/CPSU Leaders Gary E. Machlis and R. Gerald Wright at the University of Idaho, Moscow (83843) have revised their Unit's brochure, which now includes updated information on funding and staff, general scope, research activities, and extension.

* * *

Pacific Northwest

Nature Notes, a bimonthly paper intended to stimulate "old-time" interest in natural history is again in production at Mount Rainier, after a slight hiatus of 44 years. William Briggle, Mount Rainier Superintendent until his recent appointment to Deputy Director of the Pacific Northwest Region, announced the resumption of *Nature Notes*, which began publication in 1923 and was discontinued in 1939. As in the early days, the park's chief naturalist will act as editor. Objective is to stimulate interest in the park and its resources and to highlight the natural history "so easily missed amidst the day-to-day bustle of the 1980s," Briggle said.

* * *

A *Summary Prehistory and Ethnography of Olympic National Park*, by Eric O. Bergland has been compiled and published by the Cultural Resources Division of the Pacific Northwest Region, NPS. The report is a synthesis of available environmental, archeological, and anthropological literature, augmented by a limited amount of fieldwork conducted in and around Olympic NP, Wash. Bergland himself, an archeologist, was part of a 1982 research team there, working with historians and architectural historians. Bergland points out that a large portion of the prehistory of the Park is "highly speculative" and amounts to a "series of suggested trends which parallel cultural developments noted for other more well-studied regions in the Northwest." He looks forward to "further testing and research."

Studies Funded

The North Atlantic Regional Office has been funded for studies on human impacts on dunes. Work will be carried out at Indiana Dunes, Sleeping Bear, and Pictured Rocks National Lakeshores. Sociological analysis of visitor behavior and expectations in these parks and in dune resources has been contracted to Arndorfer Associates of Apple Valley, Minn. Their work will be analyzed to determine the need for further research and/or to formulate management recommendations. Persons interested should contact Reg. Chief Scientist Gary Larson or our field coordinator, Ronald Hiebert at Indiana Dunes.

New Alaska Parks Present Challenge For Interpreters

"The Challenges for Interpretation in the New Alaskan Parks" was the title of a paper given Oct. 6, 1983, by R. Gerald Wright, associate professor of wildlife resources and project leader at the University of Idaho NPS/CPSU, before the Northwest Association of Interpretive Naturalists meeting in Moscow, Idaho.

National Park interpretive programs have evolved over the years in consort with park resource management policies, Wright told the naturalists. Today, programs on animal life are an important if not dominant theme in many parks. These programs have helped make the protection and the sanctity of all species two fundamental concepts most visitors associate with parks.

The policies which permit sport hunting in the Alaska preserves and subsistence hunting on all new Alaskan park lands, Wright said, may clash with such traditional expectations and feelings. Encounters with sport hunters, because they are more prevalent than subsistence users in NPS areas, may cause the greatest problems.

"Thus there is a need," Wright said, "to develop programs that will prepare the visitor for encounters with different user groups and help them to understand the present management policies. This means that naturalists will have to develop a clear understanding of the role that sport and subsistence hunters have played, historically, in the management of Alaskan resources."

Wright indicated that the existing studies of subsistence use in and around the new parks are a good starting point. Training programs that will aid park naturalists in understanding resource management policies are needed, and Wright suggested that these include providing the opportunity for naturalists to gain a familiarity with guiding subsistence personalities and techniques – even to the extent of accompanying guided trophy hunts and observing subsistence harvests.

The final section of Wright's paper discussed the difficulties in initiating a viable interpretive program in the new areas because of the lack of facilities. He pointed out that while the new areas were planned as parks of the *future*, the growth in current visitation has been dramatic – bringing the problems of serving the visitor with adequate interpretation sharply into *present* focus.

***Figure 1** — Dam-released flood waters in 1983 created the largest flood through the Grand Canyon section of the Colorado River since the dam went into operation in 1963.*

Effects of Colorado River Flooding on Riparian Nesting Birds Studied

By Bryan T. Brown and R. Roy Johnson

A record snowpack in the Rocky Mountains combined with a rapid spring snowmelt caused the Green and Colorado rivers to overflow their banks in June and July of 1983. A flood in excess of 100,000 cubic feet per second (cfs) rolled down the mainstream Colorado into Lake Powell behind Glen Canyon Dam, the main water control structure on the Upper Colorado River. But Lake Powell was full to capacity in June of 1983, as it had been since 1979. The massive flooding was unexpected and there was no extra storage space behind the dam. As a result, huge amounts of water were released through Glen Canyon Dam's spillways and turbines (Fig. 1) creating the largest flood through the Grand Canyon section of the Colorado River since the dam went into operation. The floodwaters through the Grand Canyon NP inundated camping beaches, disrupted both private and commercial rafting operations, and flooded riparian vegetation adjacent to the river (Fig. 2).

The reservoir-induced flood in Grand Canyon occurred at precisely the time when many riparian birds along the river were at their breeding peak. The nests of several species of nesting birds were inundated. Scientists at the Cooperative National Park Resources Studies Unit/University of Arizona, involved in a long-term program of monitoring breeding birds along the river for the last 14 years, were present at the time and were able to document the rate of nest loss. At least half of all Bell's Vireo and Yellow-breasted Chat nests were flooded, while apparently 100% of Common Yellowthroat nests were destroyed. In the Southwest, these three species are restricted to riparian habitat types, with over 90% of their entire populations within the park residing along the Colorado River corridor. The flood made it apparent that the water management activities of the dam can and do affect breeding birds along the river in Grand Canyon through a complex interaction that has formed since construction of Glen Canyon Dam in 1963.

Prior to the dam, the Colorado River through Grand Canyon experienced huge annual floods varying from 50,000 to over 300,000 cfs, in a natural cycle that scoured its banks of virtually all woody vegetation. With construction of the dam at a point 15 miles upstream from the park, the annual floods were eliminated and a lush zone of woody riparian vegetation began to develop along the formerly scoured riverbanks. By 1970, a "new" riparian zone, dominated by the exotic shrub salt cedar *(Tamarix chinensis)*, had developed. Native shrubs including willow (*Salix* spp.), seepwillow (*Baccharis* spp.), mesquite (*Prosopis velutina)*, and arrowweed *(Tessaria sericea)* also were present to a lesser extent. By 1975, approximately 200 to 400 hectares of riparian vegetation were present in the pre-dam flood zone downstream of Glen Canyon Dam.

This new habitat was quickly colonized by riparian breeding birds. The arid Grand Canyon formerly had supported only small, scattered populations of these birds; by 1975, their populations in the park had increased 10-fold or more in response to the new habitat. Bell's Vireo, which prior to the dam had existed in a few isolated pockets of riparian vegetation in the extreme western Grand Canyon, expanded its breeding range over 100 miles upriver. Vireos along the river increased from a postulated 10 pairs (or less) in 1953 to over 135 pairs in 1982. These changes in vireo status were recorded by NPS Research Scientist Steven Carothers and Senior Research Scientist R. Roy Johnson during the 1970s as part of the jointly funded Colorado River Research Program, which was the Western Regional office's no. 1 science priority at that time. Vireo population changes have been further documented by Research Assistant Bryan Brown during the past two years.

The absence of large flows below the dam allowed the new zone of riparian vegetation to develop. Post-dam flows have predictably fluctuated in response to power generation commitments of Glen Canyon Dam, but in general have remained far below pre-dam maximum flows. Annual maximum discharges from the dam between 1963 and 1979 varied from approximately 20,000 to 40,000 cfs, excluding the anomalous year of 1965 (Fig. 3). Daily discharges from the dam are tidal in nature, often rising and falling 10 feet in a day, in response to a peaking power

***Figure 2** — Camping beaches were inundated, rafting operations disrupted, and riparian vegetation flooded through Grand Canyon National Park.*

generation schedule. Daily maximum discharges of a normal year (1982) are presented in Figure 4.

The flood in the spring of 1983 (as with the spring flood of 1980) occurred because there was no extra storage capacity behind the dam and uncontrolled amounts of water had to be released through the spillways. The river was running above normal during April and May of 1983, but the big rise in water levels above May's base flow of 28,000 cfs did not begin until June 2 (Fig. 4). By June 7 the river was flowing at 52,000 cfs and had reached 62,000 cfs by June 20. The maximum release of 93,200 cfs occurred on June 28, after which the river began to fall slowly back to normal levels.

The next inundation rates of three riparian birds, Bell's Vireo, Yellowbreasted Chat, and Common Yellowthroat, were particularly high and are used to illustrate the effect of flooding on nesting birds. Nests of these three species, which had been located and marked during April and May of 1983 or during the spring of 1982, were revisited during the flood to determine the effects of high water. Bell's Vireo nests are located an average of three feet above the riverbanks in low riparian vegetation, making them more susceptible to inundation. Of a statistically representative sample of 75 vireo nests visited, 45 nests (60%) were inundated by intermediate flows of 62,000 cfs and an estimated 75% were inundated by the peak flow of 93,200 cfs. Using nest heights above ground, river gage height readings, and measured water level readings at nest sites, it was estimated that vireo nest inundation first began to occur at approximately 41,000 cfs. Figure 5 illustrates the resulting curve of nest inundation correlated with river flow along the Colorado River corridor.

Yellow-breasted Chat nests are located an average of 5 feet high in the riverside vegetation and so were spared the extent of nest inundation experienced by other, lower-nesting birds. Nevertheless, 2 (11%) of the 17 chat nests visited were inundated by flows of 62,000 cfs, and it is estimated that the peak flows of late June flooded 9 (47%) chat nests.

Common Yellowthroats experienced the highest rate of nest loss from floodwaters for riparian breeding birds. The small sample size of only one active nest was inundated beneath 6 feet of water at the intermediate flows of 62,000 cfs. Since Yellowthroats nest within 3 feet of the ground in the lowest-lying marshes along the river, it is estimated that 100% of their nests were destroyed. Calculations show that Yellowthroat nests apparently are inundated by flows of as low as 35,000 to 40,000 cfs.

The overall impact of nest inundation would have been much greater if the peak flow had arrived two to four weeks earlier. Bell's Vireo normally produces two separate clutches in the Grand Canyon, with the nesting peak occurring in late May. At the time of the initial high flows, the majority of young vireos already had fledged. However, 46% of vireo nests were still active when the first high water arrived. By multiplying this 46% by the 60% of active and inactive nests inundated by 62,000 cfs, it can be calculated that only 28% of all active nests were inundated by that water level.

Yellow-breasted Chat breeding, however, was at its peak in early June when floodwaters in excess of 50,000 cfs arrived. Only 11% of the chat nests were inundated by intermediate flows of 62,000 cfs, but 100% of these nests were active at the time. When the peak flow arrived on 28 June, only 75% of the chat nests were active. As a result, only 35% of these late active nests were inundated.

The nesting chronology of each species varies, but nesting for each peaks in the bell-shaped curve of occurrence. Thus, flooding late or early in the curve does not inundate as many active nests as a flood during the peak of nesting activity.

In addition to the direct, measurable impact of nest inundation by flooding, there are other, more subtle effects on breeding birds. The flooding of riparian vegetation eliminates the lower foraging zones needed by some species. Bell's Vireo, for example, largely forages for insects in the first nine feet above ground; the majority of this foraging zone along the Colorado River was inundated in late June 1983. Floodwaters remove ground cover and strip small dead twigs and branches from live vegetation, leaving a less dense habitat.

As vireos nest only on tiny twigs occurring primarily in the first 3 feet above ground, the number of potential vireo nest sites may have been reduced. Other species requiring habitats with a higher foliate volume

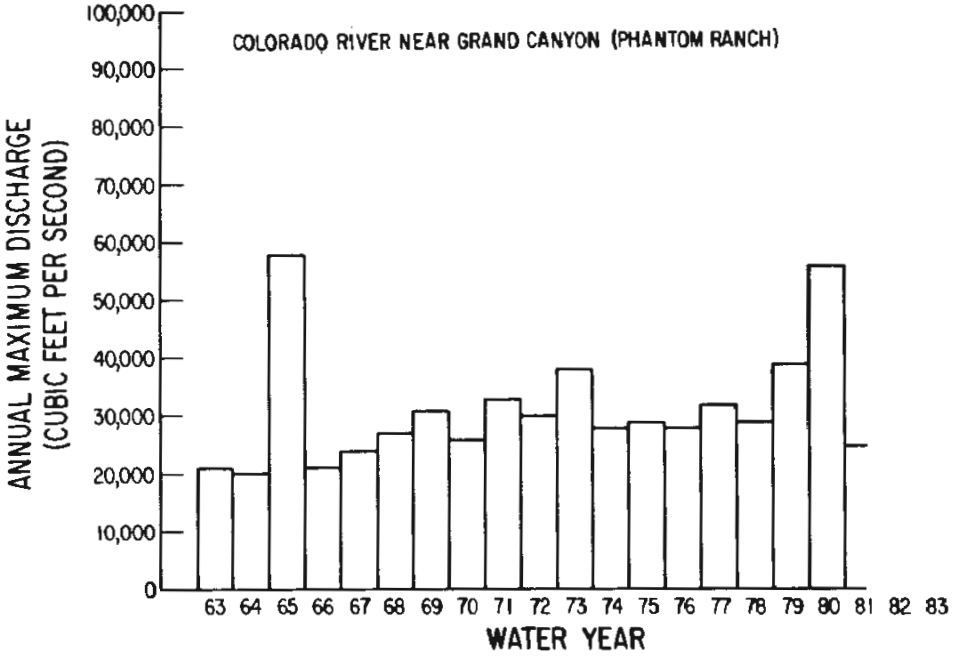


***Figure 3** — Annual maximum discharge of the Colorado River near Grand Canyon (Phantom Ranch gage) for water years 1963 and 1983. Water year 1965 had an anomalous high flow, whereas the high discharges of 1980 and 1983 are the result of emergency discharges through the spillways of Glen Canyon Dam.*

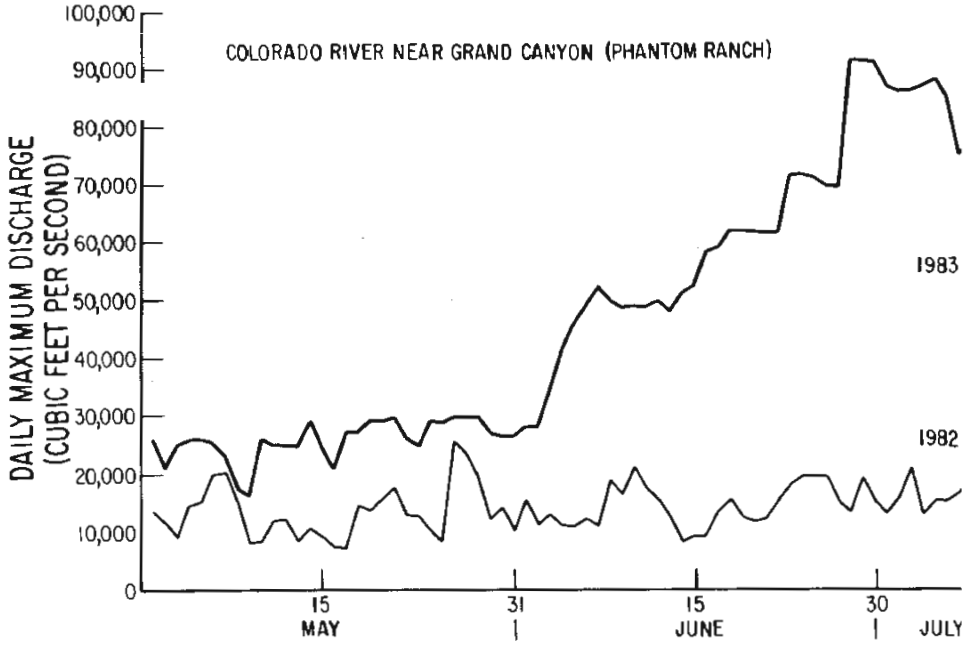


***Figure 4** — Comparison of daily maximum discharge of the Colorado River near Grand Canyon (Phantom Ranch gage) during the spring of 1982 (a normal year) and 1983.*

and shrub stem-count may find flood-altered vegetation unsuitable for breeding for a number of years after flooding. Habitat loss is accelerated by floodwaters; the total extent of habitat erosion and the effect of that loss on future breeding seasons can only be estimated at present. Continuing studies are planned to measure these effects.

Ironically, Glen Canyon Dam is the historic agent that made life possible for so many riparian birds along the Colorado River and also the agent presently capable of destroying the season's nesting attempt of an entire species. The river and its associated riparian habitat are now systems manipulated by man via water releases from the dam, even inside Grand Canyon NP. It is now the responsibility of man to manage these national heritage systems to maintain an acceptable level of compromise with regard to energy production, flood control strategy, and breeding bird diversity and productivity. Riparian habitats in the Southwest, as well as those birds it supports, have been greatly reduced in extent by man's activities during this century. This new habitat in Grand Canyon represents the single most outstanding example of an increase in riparian vegetation and riparian birds in the Southwest and as such deserves special attention as a valuable man-made habitat.

Floods similar to that of 1983 may occur again in Grand Canyon. With the reservoir behind Glen Canyon Dam being filled to capacity as it has been since 1979, another wet winter in the Colorado River drainage could again necessitate release of excess water through the dam. The flood evidently had the unexpected and positive effects of redepositing river sediments, cleaning heavily used beaches, and stimulating new growth in decadent stands of riparian vegetation. These positive effects make the limited use of floods in Grand Canyon a potential future management tool.

Floods can and should be avoided during the late spring when bird nesting is at its peak along the river. Planning ahead on the part of management would result in the release of unneeded water from the dam before the water reaches crisis levels. Water could be released during the winter when overall impacts to breeding birds would be minimal. The goal of any such management action would be the maintenance of diversity and productivity in the riparian bird community.

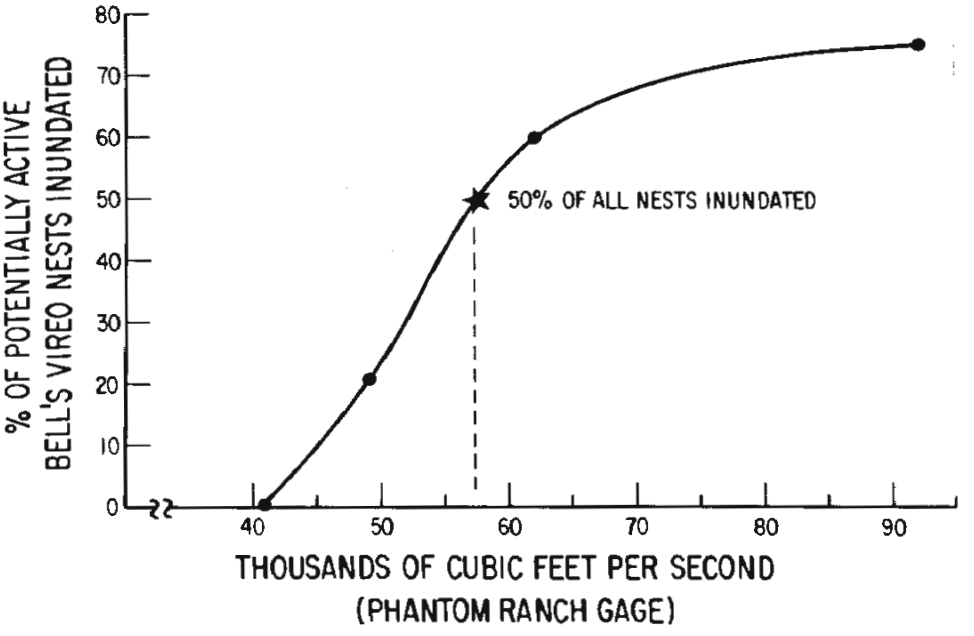


Figure 5 *— Bell's Vireo nest inundation resulted from various flow levels of the Colorado River, June 1983. The data point for percent inundation at 62,000 cfs is accurate; the three other data points have been projected from available data and are accurate to approximately ±5,000 cfs. By extrapolating from the curve of the graph it can be seen that approximately 50% of all nests were inundated at the 57,000 cfs levels.*

Johnson is Unit Leader of the Cooperative National Park Resources Studies Unit at the University of Arizona; Brown is a Biological Technician with the unit.
(Photos are by Brown)

Global Network To Monitor Air Pollution Started

By Bruce Wiersma

The International Biosphere Reserve Program has many uses, one of which is to provide a locale for background monitoring. This monitoring would cover not only pollutants but also ecosystem processes and functions.

These reserves: (1) act as locales for establishing levels of pollutants; (2) provide a frame of reference against which changes in more impacted areas can be compared; and (3) may reflect changes in pollutant levels of a global nature long before such changes are obvious in more impacted areas. In other words, biosphere reserves can serve as an early warning system for pollutants transported over long distances.

The National Park Service has supported research on the development of techniques for measuring pollutants in remote biosphere reserves, determining their distribution in these reserves, and trying to obtain estimates of their movements through these reserves. Currently work is proceeding with the cooperation of the NPS, Dr. Jerry Franklin's team of USFS personnel, and Oregon State University and the Department of Energy's Idaho National Engineering Laboratory to continue much the same kind of research in Olympic National Park, a designated biosphere reserve.

The work in Olympic NP will be coordinated with similar kinds of monitoring, both for pollutants and ecosystem parameters, in two other countries, the Soviet Union and Chile. In the former case, the work is coordinated through the US/USSR Bilateral Program on the Environment. The reserve is likely to be the Berezhinski Reserve. Meetings on cooperation between the U.S. Program and the Soviet Program have taken place on numerous occasions over the last five years, the most recent being discussions held at Sequoia/Kings Canyon NPs.

The Chile site is in the Torres del Paine National Park. Funded from contribution through the UN Environmental Program's Global Environmental Monitoring System, this work will consist of measurements similar to those being made in Olympic NP, measuring pollutants and ecological parameters. The work in Chile is being conducted by the Chilean National Forest Service, CONAF, with cooperators from the University of Chile and Catholic University in Santiago.

These three sites will serve as a pilot network to test techniques and coordinating procedures among the three locations. Coordination will be maintained through the Global Environmental Monitoring System of UNEP, with input from the World Meteorological Organization and the UNESCO's Man and the Biosphere Program. This project will also be a component of the US Man and the Biosphere Pollution Directorate Program, MAB 14. Eventually it is hoped that the program will expand to a larger number of sites around the world and will continue on a long-term basis. The program is currently planned to be coordinated with other existing networks, such as the U.S.'s National Atmospheric Deposition Program and the World Meteorological Organization's Background Monitoring Program.

Wiersma is manager of Earth & Life Sciences, EG&G Idaho, Inc., P.O. Box 1625, Idaho Falls 83415, and chairman of MAB Directorate on Environmental Pollution

Golden Gate Uses Team Approach On 'Monumental' Resource Problems

By Judd A. Howell

At times the problems facing natural resources management in any park can seem insurmountable. Limits in funds and staff set the scope of reasonable accomplishment during a work year. Much was written in the recent past about the importance of natural resources management. The *Threats to the Park* report identified the diversity of major problems the national parks face. Within each park, the diversity of problems that must be dealt with on a continuing basis is monumental.

In a park like Golden Gate the natural resources management problems can be intensified by the press of 22 million visitors each year. Being relatively new to the National Park system, Golden Gate has an immediate constituency with limited understanding about the natural values of the park.

Names such as "recreation area" and "urban openspace" conjure up innumerable visions and biases that are tied to these concepts but not necessarily to the land and the resources on them. Even with an approved Natural Resources Management Plan (NRMP), the budgeting process is slow, competition for priority is intense and prospects for measurable progress are slight.

This report describes a management system that can help overcome the above problems. The system can make a difference in the rate of progress and employee morale. It is not a panacea. As with any management system, its success is a function of the personalities involved. The following is a discussion of Golden Gate's natural resource management teams – their inception, organization, accomplishments and pitfalls.

Organization

In January 1982 a background questionnaire was developed to assess the ability and interest of Golden Gate's staff (250 people) to deal with natural resources problems. The questionnaire examined formal training, interests, and hobbies as they related to natural values of the park, regardless of an individual's current position. In addition to knowledge and skills, project titles were listed that corresponded to project statements in the NRMP. Respondents were asked to number in order of preference the projects they wished to work on.

The initial response indicated a high degree of interest in natural resources programs. Forty-six people responded, 26 of whom had some natural resources training. The majority (36) had baccalaureate degrees and four had masters degrees. Of the original 46 respondents, 40 indicated that they wanted to work on natural resources projects.

Tally sheets were developed to examine each person's education and priority project preference. Each respondent was categorized into one of six areas of expertise based on education and preference. The six areas of expertise corresponded to subject areas identified in the NRMP; aquatic resources, botany, geology, vegetation management, wildlife management and range management. The technical areas formed the basis for the natural resources management teams.

The natural resources management teams have a five-fold purpose. First, the teams provide more effective utilization of existing natural resources expertise within the park. Second, the teams begin implementation of the NRMP. Third, the teams act as an interim management vehicle until identified resource management positions can be filled. Fourth, the teams provide technical and labor support for existing natural resources management staff (currently one Natural Resources Specialist). Finally, the teams provide for effective utilization of Volunteers in Parks (VIPs) through team activities.

Three basic goals were established for the first year. The first was to begin implementation of the NRMP (Table 1). The second was to develop project statements for additional projects (Table 2). The final goal was to develop projects for summer youth programs within the framework of the NRMP.

The teams were organized to correspond to the six technical areas described in the NRMP. The park's Natural Resources Specialist supervised the teams for consistency with the NRMP, technical content and quality of work produced. Each team elected a team leader who met monthly with the Natural Resources Specialist to evaluate team direction and accomplishment.

The teams met each month independently; team leaders were responsible for unity and continuity of team effort. The leaders organized the monthly work program, assisted in work assignments, and assessed the status of the team.

Individual team members contributed some work time to natural resource activities. The superintendent permitted up to 10 percent of an individual's work time to be spent on team projects with supervisory approval. Team members met monthly with the leader to report progress and organize work activities.

With the purposes, goals, and framework established the teams began enthusiastically chipping away at the natural resource management mountain. Generally, the teams settled down to a solid core of about 33 people. Some turnover occurred because of the large number of seasonal appointments. During the year 14 additional applicants filled out questionnaires and half were used to fill gaps in team membership. The range and vegetation management teams were consolidated because of the small number of individuals on the range team. This left five functioning teams.

Results

Since April 1982, five natural resources management teams worked on projects ranging from staff training to resources protection to project statement writing. The time each individual spent on team activities varied from as little as 10 hours to over 300 hours; the latter included on and off duty time. The vegetation management team for example had 10 active members who worked a total of 441 hours for the year. Theoretically, 20 team members working 10 percent of their time would provide 2 work years. Realistically, for the teams' first year about 1 work year was completed.

The aquatic resources team was especially active. Early on, the team was trained to conduct stream surveys. A volunteer fisheries biologist (retired Forest Service) conducted a two-day training session. With knowledge in hand, the teams:

Table 1. List of Natural Resource Projects

Golden Gate National Recreation Area

Reference Number	Park Priority	Project Title	Status
RM-1*	1	Range Management	Proposed
RM-2	2	Exotic and Noxious Plant Control	Proposed
RM-3	3	Erosion Hazard Rehabilitation	Proposed
RM-4	4	Vegetation Management, S.F.	Proposed
RM-5	5	Dog Control	Proposed
RM-6	6	Fallow Deer Management	Proposed
RM-7	7	Water Resources Management Plan	Proposed
N-1*	2	Endangered Plant Survey	Proposed
N-2	10	Plant Community Mapping	Proposed
N-3	4	Erosion Hazard Survey	Proposed
N-4	5	Beach Monitoring Program	Proposed
N-5	6	Predation of Deer	Proposed
N-6	3	Aquatic Resources Study and Monitoring	Proposed
N-7	7	Monitoring Sensitive Nesting	Current Yr. 1
N-8	8	Marine Resources Monitoring Program	Proposed
N-9	9	Marine Mammal and Bird Monitoring	Proposed
N-10	1	Fire Research for Management	Proposed

Projects Requiring Additional Assessment

**RM – Natural Resources Management Project*
**N – Natural Resources Research Project*

– conducted periodic stream surveys of Redwood Creek, a silver salmon and steelhead trout spawning stream that flows through Muir Woods;

– assisted California Department of Fish and Game personnel in a survey of Lagunitas Creek, which contains California freshwater shrimp, an endangered species;

– conducted a staff training for all districts and U.S. Park Police in Dungeness crab identification and protection; (the crabs, threatened by poaching, are a significant resource of San Francisco Bay);

– developed and conducted a monitoring program of Rodeo Lagoon during bridge construction. The lagoon is the last habitat of the Tidewater goby in the Bay area. Tidewater goby spawning habitat would have been destroyed without bridge design modification and careful monitoring during construction.

The botany team conducted a review of the literature about endangered plants in the park. Contacts with local conservation groups and research institutes were made. A staff training was conducted on identification of endangered plants. Members of the California Native Plant Society (CNPS) conducted the training. After the training, the CNPS provided five complete sets of photographs and distribution maps of endangered plants for each district.

The geology team developed a landform survey to evaluate erosion hazards in the park. The survey provided the basis for establishing priorities for correction and summer youth program projects. The team members and district staff were trained by the team leader, a physical geographer, to conduct the surveys. Updates to the survey are being conducted in certain locations by volunteers from San Francisco State University.

The vegetation management team had a slow start, but became the most effective in utilizing volunteer groups. They conducted fuel sampling in local Eucalyptus groves, which present extreme fire danger in California's Mediterranean climate. Volunteers from Urban School, a local high school, assisted the team in fuel sampling, establishing two fire-weather stations, planting native perennial grasses and stabilizing a heavily trampled endangered plant site. Other team members used volunteers from George Washington High School to eradicate forget-me-nots on the valley floor of Muir Woods. Team members also were active in removing pampas grass, another exotic plant.

Table 2. List of Projects Requiring Additional Assessment

Mammal Censuses
Bird Censuses
Feral Cat Census
Trail Survey
Herpetological Census
Thistle, Scotch, and French Broom Research
Blowing Sand Study
Reestablishment of Native Perennial Grasses
Reintroduction of Tule Elk
Reintroduction of Natural Predators (Coyote and Mountain Lion)
Develop Raptor Observatory
Feral Pigs from MMWD Watershed

The wildlife management team developed management guidelines for a colony of bank swallows . . . the most northern coastal colony in California and of special interest to local Audubon groups. The cliffs, which are prime nesting habitat, have been extensively trampled by visitors. A volunteer associated with the team began surveys of marine mammals and birds. Another volunteer is collecting and curating the park's insect collection.

In cooperation with Point Reyes Bird Observatory, the team continued a system of beached marine bird and mammal monitoring, conducted monthly surveys of avia fauna on Alcatraz Island, and put on a park staff training exercise in the use of wildlife observation forms to upgrade the park's data base.

Training provided team members by the National Resources Specialist included statistical methods, biological sampling and a field exercise. In addition, other teams developed project statements to direct future resources management actions.

Discussion

Productivity of the natural resources teams for their first year was very high and covered a broad spectrum of activities. The teams accomplished the three primary goals; implementation of the NRMP, writing project statements, and developing youth program projects. They also provided an efficient matrix for utilizing volunteer support. Team membership cut across all divisions in the park – maintenance, administration, and ranger activities.

The natural resources teams did not operate without problems. Lack of experience among team members led to uncertainty about what to do and how to do it. Once training began, the teams began to coalesce and progress became apparent.

The second major problem was gaining supervisory approval for participation. Even with strong support from top management and enthusiasm from park staff, some mid-level managers acted as stumbling blocks, making team member participation difficult if not impossible. This complaint was voiced by all teams. Team activities went beyond district boundaries and a considerable amount of work reciprocity occurred between districts. Once this was realized, some mid-level managers began to support the natural resource team program.

A third problem was team member turnover, creating difficulty with continuity. The personnel division now includes the natural resources questionnaire and team description with new employee orientation packets.

Even with the problems, the success of the natural resources teams is apparent. The teams provide a creative outlet for a number of employees to fulfill their personal NPS goals. The training and experience gained by team members help park management meet EEO goals. As technical staff come on board the teams can continue as a valuable extension of Golden Gate's natural resources management capability.

Howell is a Natural Resources Specialist at Golden Gate NRA.

BLM in the Saddle — Burros Headed for Last Roundup

What do you do if you're the Natural Resources Specialist for a 2,067,793-acre National Monument and you have 4,000-odd feral burros to get rid of within three years?

Hint: You don't sit down at a desk and write a story about it.

Which is how *Park Science* came to do its first telephone interview. The interviewee was Pete Sanchez of Death Valley NM.

"Every time I pick up a copy of *Park Science* I wish I had time to write something for it," Sanchez said on October 17, when the editor called him to ask for a story on the burro roundup.

"I could agree to do it," he said, "but I know I wouldn't have the time, and then we'd *both* be mad."

Would he have time to answer some questions on the phone?

He would. So here's what's happening at Death Valley, mostly in Pete Sanchez's own words.

The last census of Death Valley NM burros, in 1982, showed a count of approximately 2,500 animals. The yearly increase is about 16 percent, factoring in mortality. "I've seen the burro population double since 1969," Sanchez said, "and I hope I'll see the problem solved in the next three years."

The plan calls for total removal of burros from Death Valley, in an operation beginning in FY 1984 and ending at the end of FY 1986. "Our goal is half the animals this year, half the remaining half in the second year, and the remainder the third year," Sanchez said.

The actual roundup work is being done on contract by BLM wranglers, who started the job on October 4 and had shipped out 79 animals as of October 17. "BLM has the expertise, the equipment, and the personnel," according to Sanchez. The eight wranglers on board as of October 17 will work into the spring, rounding up the burros from horseback, trucking them to Ridgecrest, Calif., and there turning them over – at a holding facility – to a consortium of animal protection groups.

The consortium consists so far of the Fund For Animals, NOWAH (National Organization for Wild American Horses), the International Society for the Protection of Mustangs and Burros, and the Humane Society of Southern Nevada. All consortium participants have signed an agreement with NPS to accept the burros removed by the NPS, and find homes for them, nationwide.

information crossfile

From John Dalle-Molle at Denali NP comes word of a USFWS Special Scientific Report, No. 252, on Nonconsumptive Outdoor Recreation: An Annotated Bibliography of Human-Wildlife Interactions by Stephen Boyle and Fred Samson. This 1983 publication contains 536 annotated citations and keywords complete with keyword, author, species, and geographic indexes. The publication can be had from USDI, USFWS Editorial Office, Aylesworth Hall, CSU, Fort Collins, CO 80523.

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Clifford Smith, director of the University of Hawaii NPS/CPSU, writes about a new service available from BioSciences Information Service (BIOSIS). They will now generate their search output onto diskettes, from which you can generate your own literature database. This can be manipulated in many different ways using a software package called BioSuperfile. Basic costs are:

500 citations each year: without abstracts $100 p.a.; with abstracts $160 p.a.; discs $2.70 ea.; BioSuperFile $100.

Diskettes are mailed each month.

For those interested, the MICRO/B-1-T-S Subscription agreement can be obtained from BIOSIS User Services, 2100 Arch St., Philadelphia, PA 19103-1399.

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A $1,000 award for "the stalwart defenders of America's natural heritage who put commitment to principles ahead of personal gain" has been unveiled by the National Parks & Conservation Assn., and named for the National Park Service's first director. The Stephen T. Mather award will be made each year in May. The winner, selected from a field of seven regional finalists, will receive the cash prize. Any public servant employed at the federal, state, county, or local level in the field of natural resource management is eligible.

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Late in August, the U.S. and Canada signed an agreement to co-sponsor a study that will simulate the movement of airborne pollutants that cause acid rain. The October issue of *Discover* described briefly the six-week study that began in September 1982 and is named Captex (for cross-Appalachian tracer experiment) and that is expected to help resolve the U.S./Canada dispute over who is exporting acid to whom.

In the same issue, Jamie James examines the whole problem, under the title, "Who Will Stop the Acid Rain?" Many an unsolved question with regard to acid rain is explained in lay terms. For instance, scientists *believe* that tree kills result primarily from the acid in rain reacting chemically with clay soils to release aluminum and potassium – metals toxic to the fine root systems of trees. The metals are then carried into water bodies, where they kill aquatic life. Fish, it seems, are extraordinarily vulnerable to aluminum poisoning.

One worrisome aspect is raised by William Ackermann, professor of civil engineering at the University of Illinois. Ackermann says increased acidity may be dangerously disturbing the microorganisms in soil. These are the life forms that constitute the bottom of the food chain, where dead plants and animals are turned back into the nitrogen and carbon essential for building new life. In effect, Ackermann suggests that acid rain may be unraveling one end of the food chain, upon which virtually all known life depends.

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Genetics and evolution crop up in a general way several times in the October 1983 issue of *Discover* – from the "Personality" piece on Francisco Jose Ayala entitled "Genetics, Grapes, and the Good Life," to the Ecology section piece on El Nino and the way Pacific life is struggling to survive and adapt in a warming sea.

To those who attended the NPS-sponsored 1982 Conference on Genetics and Conservation in Washington, D.C., it comes as no surprise to learn that "Ayala has demonstrated that heterogeneity is important to survival." *Discover* author Kevin McKean writes: "Apparently, natural selection has hedged its bet on the conditions the flies (*Drosophila melanogaster*, used by Ayala in his research) may encounter . . . flies with a high degree of genetic variability evolve faster and survive better under adverse conditions than flies with a more limited repertoire of genes."

The story on El Nino treats the ocean phenomenon in much the same way science is treating the Mount St. Helens story – as a magnificent natural experiment. Richard Barber, a marine biologist at Duke University, found genetics and human intervention interacting in a stately dance that adds up to what he calls "qualitative overfishing" in the anchovy fishery off Peru. He also calls it "overfishing with a twist." His research goes back to the 1972 El Nino, which drove anchovy numbers down from 13 million tons per year to the present 2 million ton yield.

Barber asked himself why the anchovy fishery failed to rebound when the 1972 El Nino ended. "The largest and hence most easily found schools are produced by the most fecund fish," he reasoned. These fish already had been caught. Barber concluded that "the remaining fish lacked the genetic ability to reproduce as fast as necessary to bring the population back up to pre-El Nino levels."

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An Associated Press story filed out of Jacksonville, Florida on Nov. 18, 1983, tells of a young Kemp's Ridley turtle less than a foot long and weighing about 5½ pounds, found Nov. 9 on a Cape Cod beach under conditions that strongly suggested it had been hibernating.

C. Robert Shoop, a professor of zoology at the University of Rhode Island, found the turtle. On its shell were growths of algae and sea lettuce, which led scientists at the URI's School of Oceanography to believe it had been buried in the mud at the bottom of Cape Cod Bay.

"The thing that makes it very important is that it has this indication that it was hibernating. That's never been shown before," Shoop said. The turtle was sent to Marineland in Florida for further scientific study, after which, if it is healthy, it will be released in the Gulf.

Before the discovery, scientists thought younger turtles of the Kemp's Ridley species were carried up the East Coast by the Gulf Stream each spring and then swam south for the winter. Now, Shoop told AP, it may turn out that some of the young Kemp's Ridley turtles actually hibernate during the winter in the colder waters of the Northeast.

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The potential for hazardous volcanic activity at several Northwest locations associated with National Parks is discussed in a general overview of U.S. volcanic activity recently put out by the U.S. Geological Survey. Entitled *The Volcano Hazards Program: Objectives and Long-Range Plans*, the Open-File Report #83-400 was authored by R.A. Bailey, P.R. Beauchemin, F.P. Kapinos, and D.W. Klick.

The 33-page report assesses the potential for future eruptions at Mount St. Helens, other Cascade volcanoes, other western lower U.S. volcanoes, Hawaiian, and Alaskan volcanoes. It describes USGS's volcanic hazards assessment, volcano monitoring, fundamental research, and emergency-response planning and public education, its long-range program, and the Federal role which includes the public need for information about impending volcanic hazards, disruption of economies, the implications for Federal lands, and the need for an integrated research program.

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Restoration and Management Notes, the University of Wisconsin-Madison Arboretum publication that serves as a news, views, and information exchange among ecologists, land reclamationists, park managers, and others committed to stewardship of plant and animal communities, carries in its Summer 1983 issue an article on "Restoration Key to Assessing Environmental Damages Liability: Interior Seeks Aid." A framework for establishing liability and damages in cases where injury has been done to the environment is being sought at Interior (in response to the Comprehensive Environmental Response Compensation and Liability Act of 1980), and DI Project Director Bruce Blanchard has asked *R&MN* and its readers to help in the development of a network of information on ecosystem restoration technology. Those interested in contributing to this project may contact Blanchard, USDI, Washington, DC 20240 (202) 343-3811.

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The Wall Street Journal continues its excellent reportage in the area of natural history with a piece by Ken Wells, staff reporter, on Morlan Nelson of Boise, Idaho, and his efforts on behalf of his favorite charity, the Peregrine Fund.

Nelson, longtime falconer and noted wildlife cinematographer, takes "an unusually cooperative approach to industry. Unlike some conservationists, he generally avoids criticizing industry for gobbling up wildlife habitat or polluting the environment," Wells writes.

The approach seems to have paid off. Nelson has lured thousands in cash and other assistance from the Idaho timber and mining concerns into the Fund and has helped persuade the Fund to move from Fort Collins, Colo., to Idaho, where it will occupy a 530-acre complex near Boise. The plan is to turn the Fund into the World Birds of Prey Center, pooling research and breeding techniques to save endangered species worldwide.

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Andrew Carey, wildlife biologist with the Old-Growth Forest Wildlife Habitat Program of the U.S. Forest Service and author of the article on Colorado tick fever in Rocky Mountain NP in the Spring 1983

issue of *Park Science*, presented two papers at a symposium on rabies in wildlife, held in Baltimore in November. One paper was on epidemiology of the Mid-Atlantic region as it relates to the spread and persistence of rabies; the other was on the ecology of rabies and evidence of co-adaptation of parasites and hosts around the world.

Principal sponsors were Johns Hopkins University, the National Center for Disease Control, and the World Health Organization.

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Have you ever wondered what the most common tree is in the National Park System? Have you ever wondered what the 10 most common trees are? Well, Jim Bennett in the Air and Water Quality Division has also and he set out to find out with the help of Gary Waggoner and Nancy Thorwardson and the NPFLORA data base. At the time they used NPFLORA the data base contained 45 national parks, all of them air quality class I areas. The following list, therefore is pretty much limited to class I parks, but it will be updated as more parks are added to the data base. Here they are:

The 10 Most Widespread Trees in the Class I Parks

Species	Number of parks
1. Populus tremula ssp. tremuloides	28
2. Prunus virginiana	26
3. Pseudotsuga menziesii	22
4. Pinus ponderosa	22
5. Juniperus scopulorum	18
6. Acer negundo	16
7. Populus angustifolia	16
8. Salix scouleriana	16
9. Acer glabrum	15
10. Cercocarpus montanus	15

The common names for these trees, respectively, are: quaking aspen, choke cherry, Douglas fir, ponderosa pine, Rocky Mountain juniper, boxelder, narrowleaf cottonwood, scouler willow, Rocky Mountain maple, and mountain mahogany. The large number of western species is due to the bulk of the class I parks being in the western U.S.

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A paper entitled "Rationalizing Management of Natural Areas in National Parks" by Dave Graber, NPS research scientist at Sequoia and Kings Canyon NPs, is scheduled for publication in the George Wright Society *FORUM's* Fall issue. In essence, Graber proposes "a small extension of the policy evolution process that has been taking place for decades" toward replacing the "scene management" concept in park policy. Specifically, he proposes that any exceptions to the basic resource management goal for natural and wilderness areas of unimpeded interaction of native ecosystem processes and structural elements "be explicitly stated and justified for each resource management plan."

Graber argues that a world coping with radiation, acid rain, air pollution, deforestation and desertification there is urgent need for "sites where what remains of natural ecosystem functioning may be studied and where baseline values for system elements and their interactions can be established and monitored." He traces the evolution of NPS policy in this regard and suggests that "for many systems in this country only national parks are sufficiently large and undisturbed to serve the purpose."

mab notes

The National Aeronautical and Space Administration has joined the MAB program as a funding agency. NASA recently launched Global Habitability – a program intended to expand the use of remote sensing and related technologies to identify and assess causes and effects of changes in air, water, and land components of the biosphere. As in MAB, particular emphasis is on those changes that affect human habitability. NASA has expressed interest in the use of biosphere reserves as sites for systematic collection of ground truth data in conjunction with data provided by satellite and aircraft-based platforms. Proposals should be directed to the MAB coordinator, Bill Gregg, National Park Service Washington Office.

A potential study this fiscal year involves use of aircraft and satellite imagery to quantify land use changes in the vicinity of biosphere reserve areas during the period of record – several decades in most areas – to give an idea of the location, nature, and rate of encroachment.

Selection of Biosphere Reserves

Selection panels will be convened this year for the California biogeographic province (chaparral and Central Valley grassland regions) and the Lake Forest Biogeographic Province (mixed hardwood forest region from Minnesota to Maine, including adjacent areas of Canada), the latter in cooperation with MAB Canada. Kheryn Klubnicken, environmental specialist at Santa Monica Mountains NRA, is coordinating the effort in California, and Glen Cole, research biologist at Voyageurs NP, is assisting with the Lake Forest initiative.

Testing of the 1981 MAB guidelines for selection of coastal area biosphere reserves is nearing completion, under Susan Bratton and Monica Turner of the NPS/CPSU at the University of Georgia's Institute of Ecology. Candidate sites have been identified and information for evaluating them summarized for the selection panel which is convening in January 1984 at Cumberland Island NS.

Death Valley and Joshua Tree NMs have been recommended as units of a Mojave and Colorado Deserts biosphere reserve by a selection panel chaired by Norden H. Cheatham of the University of California Natural Land and Water Reserves System. The sites were approved for nomination by US/MAB at the December meeting of the Directorate on Biosphere Reserves, pending NPS concurrence.

Status of MAB

On June 30, 1983, the MAB Secretariat was administratively transferred from the State Department's Bureau of International Organization Affairs to the Bureau of Oceans and International Environmental and Scientific Affairs. State funding and staffing levels were maintained.

In the aftermath of the April 1983 congressional hearings on MAB, a small executive committee was established to plan the future of MAB, replacing the large MAB National Committee of former years. The committee's new chairman, Dr. Paul Baker (chairman of the Penn State Anthropology Department) has sparked congressional interest in a line item appropriation in State's budget for MAB in FY 1985. MAB now is developing plans for a $2 million program for that year. The Life Sciences Committee of the National Academy of Sciences has agreed in principle to have the Academy assume a substantial role in MAB. A recent NSF evaluation of the UNESCO science programs underscored the effectiveness of MAB and its many benefits to the United States.

First International Conference on Biosphere Reserves

The First International Congress on Biosphere Reserves was held in Minsk, Byelorussian S.S.R. from Sept. 26 to Oct. 2, 1983. Eight individuals from the United States attended, with the U.S. Government represented by NASA. Fifty-two nations sent representatives. The Congress developed an action plan for biosphere reserves, soon to be available in final form. Papers prepared by Lloyd Loope (NPS research biologist from Haleakala NP), Ray Herrmann (NPS Water Resources Lab director,) and MAB Coordinator Bill Gregg, were read at the Congress.

Virgin Islands Marine Research

An integrated, multi-year program of marine ecosystem studies was launched in October by the NPS in cooperation with MAB in the Virgin Islands NP biosphere reserve. The research will provide a comprehensive description and evaluation of marine ecosystems and fisheries of the region, including nearby areas in the British Virgin Islands, and will develop the basis for long-term monitoring to support effective management. The work of investigators from six regional institutions is being coordinated through the Virgin Islands Resource Management Cooperative, established in 1982 to marshall the region's capabilities for addressing problems affecting the VINP biosphere reserve.

Symbolism Studied

Dr. J. Ronald Engel, associate professor of Social Ethics at the Meadville Theological School (University of Chicago), plans a year's sabbatical to study the role of symbolism and human value systems as factors in establishment and effective use of biosphere reserves in different parts of the world. Biosphere reserves represent a new dimension in global conservation, the master integrators of many functions performed individually or severally by existing kinds of protected areas, and symbolic as well as practical focal points for cooperation to improve the well-being of people through sustainable conservation of the world's ecosystems.

The success of the reserves will depend on willingness of people and their institutions to cooperate in a spirit of service to make the reserves dynamic centers for developing knowledge and practical skills for effective ecosystem management. Dr. Engel will look at how the symbolism inherent in the reserve concept is perceived by key decisionmakers and institutions, how these perceptions promote or constrain development of the reserves, and what actions MAB and others might take to foster enthusiasm and constructive work in building the global network. Dr. Engel is author of *Sacred Sands*, which assesses the role of symbolism and human value systems in the half century of efforts leading to establishment of the Indiana Dunes National Lakeshore. Dr. Engel worked for the NPS as a seasonal ranger/naturalist at Sequoia and Kings Canyon NPs and Isle Royale NP.

Thinking Man's Guide To Historic Rehab

"This is a book about how to ***think*** about historic structure rehabilitation before you start ***doing*** it."

Dr. T. Allan Comp, Chief of Cultural Resources for the NPS Pacific Northwest Region, thus described the 71-page booklet *Historic Structures Maintenance Guide,* prepared for Mount Rainier NP by Architect Alfred Staehli of Portland, Oregon.

Contents include tips on preserving the rustic style, definitions, site and grounds, landscaping, treatment of the various parts of structures such as roofs, foundations, and walls, flashing, hardware, paints and other finishes, insulation, doors, sashes and hardware, lighting fixtures, energy conservation, handicapped access, and many more related topics.

The Guide is a general introduction to rehabilitation, and as such is applicable System-wide. It is available either from Mount Rainier NP or from PNRO, Cultural Resources Division, Westin Building, Room 1920, 2001 Sixth Avenue, Seattle WA 98121.

Following production of the Guide, Dr. Comp's Division put together a 1300-page publication, entitled *Historic Structure Preservation Guide,* covering more than 100 actual buildings in Mount Rainier – complete with maps, diagrams and detailed instructions to resource management personnel as to how to proceed in rehabilitation work.

Pack-Rat Middens Hold Keys To Past

At Lava Beds National Monument in northeastern California, pack-rat middens are shedding light on historic vegetation patterns. Two middens, which have been analyzed and carbon-dated by Dr. Peter Mehringer, Jr., of Washington State University at Pullman, have returned dates of 2600 years B.P. and 5300 years B.P.

The information contained in the plant remains preserved in the middens reveals historic vegetation in the headquarters area to be nearly identical to that present today. Another midden indicates the former dominance of associations whose current abundance here and elsewhere has been partially attributed to historic fire suppression and livestock grazing. Five additional middens currently are being analyzed and dated.

The information generated by this project will be useful in reconstructing historic vegetation patterns and may influence fire management decisions on utilizing prescribed fire to return an area to "historic conditions." The carbon-dates are helping to establish minimum ages of lava tubes where the middens are found. Only small portions of each midden are collected, leaving most of the middens intact for future study and visitor interest.

Dennis Schramm
Resource Management Specialist, Lava Beds NM

A Century of Discovery Observed at Glacier Bay

By Maria Gladziszewski

The first Glacier Bay Science Symposium attracted scientists from 20 states. Some traveled 4,000 miles to talk with one another, to revisit a place where most had spent many hours. They came as scientists to discuss research at Glacier Bay; they came as observers to learn about Glacier Bay; they came with enthusiasm, hopes, and concerns for Glacier Bay; they came to be part of "The Scientific Adventure — a Century After Muir."

Originally slated as a 50-participant event, Glacier Bay's first Science Symposium became a meeting of more than 130 minds. Many among them had been hoping for a gathering of Glacier Bay scientists since the idea was discussed in the mid-1970s. The meeting was to gather scientists to summarize past research, and encourage future research in Glacier Bay.

The idea lingered in the minds of certain individuals until the fall of 1982, when it resurfaced at a meeting of the Friends of Glacier Bay. The scientific community, the National Park Service, and the Friends of Glacier Bay now seemed ready for the event. FGB and NPS agreed on co-sponsorship, individuals and organizations volunteered time and dollars.

Glacier Bay Lodge in Bartlett Cove served as the center for the Sept. 23-26, 1983 weekend activities. Participants arrived in time to begin informal discussions at a pot luck dinner. Four panels, with 8 to 10 members each, covered four main areas: Geology, glacial activity and climatology; Terrestrial ecosystems; Maine and aquatic ecosystems; and Topics in resource management.

Discussion among panel members and with the audience followed panel presentations.

Actually, the discussions, both formal and informal throughout the weekend, were as wide-ranging as the Glacier Bay setting and the human minds meeting. Glacial history, climate reconstruction, collection of meteorological and climatological data, studies of refugia, terrestrial ecosystem development, biogeography, interdisciplinary studies of the marine development, humpback whales, determination of carrying capacities, how to decide on research priorities, human resources of Glacier Bay — the subject matter was endless. Participants summarized past research findings, dissected research methods, examined unanswered questions from new perspectives, and planned future projects together.

Funds from the Alaska Humanities Forum provided two evening programs which broadened the Symposium scope to include aspects of the human relationship to Glacier Bay and introduced discussion of philosophy and values. Participants in this area included three members of the Tlingit community of Hoonah, Alaska — a poet, and archeologist, and a photographer/author. The humanities sessions presented Glacier Bay as more than just a research laboratory and offered a perspective within which to pursue science.

Three of the Bay's most distinguished scientists were honored. Former Superintendent Robert Howe presented NPS awards for extended scientific contribution to Glacier Bay to W.O. Field, glacialogist with the American Geographical Society monitoring changes in the Bay's glaciers since 1926; R.P. Goldthwait, geologist from the University of Ohio and leader of the Institute for Polar Studies multidisciplinary research program begun in the early 1950s in Glacier Bay; and D.B. Lawrence, botanist from the University of Minnesota, observing vegetation changes in Glacier Bay since 1941.

Scientists view *Glacier Bay from the decks of the tour boat, Thunder Bay.* *(Tom Bean photo)*

Formal presentations were followed by a tour boat trip in rare Southeast Alaska sunshine. The tour boat *Thunder Bay* was donated by Glacier Bay Lodge. The 8-hour trip allows scientists to revisit Muir Inlet, famous for its catastrophic glacial retreat and plant succession studies. The hum of discussion did not end until the vessel returned to Bartlett Cove dock.

Something different happened here. Participants were drawn — not pushed — to the gathering. The meeting moved from event to event with intensity, energy, and a rich spirit of sharing. Many described it as one of the best meetings they had ever attended.

Extending beyond the formal sessions as perhaps the heartbeat of the gathering was the grappling with questions such as "What is the appropriate relationship of science to the fundamental values associated with Glacier Bay the Place and Glacier Bay the National Park and Preserve? What is so special about Glacier Bay the Place? What should be the character of the Park and Preserve? What role does science have there?"

No final answers were achieved, but the dialogue was serious and pervasive. Participants brought diverse perspectives, and all sought the knowledge that Glacier Bay offered. All spoke of "carefully treading on the landscape," and throughout there was a spirit of caring.

Proceedings will be available from Gary Vequist, Resource Manager, Glacier Bay NP, Gustavus, AK 99825.

Gladziszewski, a seasonal interpreter at Glacier Bay NP, is editor of the Symposium Proceedings.

Boomtown Studies Help Predict New Visitor Patterns

By James Carroll

For some time, managers have recognized energy development and urban encroachment as problems for the national parks. Formal identification of these threats was made in the 1980 State of the Parks Report.

In recent years, however, much more attention within the National Park Service has been devoted to addressing these perils. Monitoring for air and water quality is the outstanding example, but social scientists have taken a role.

It is known that energy development creates boomtowns, which is another way of saying that almost overnight certain communities will experience sudden population growth, or be created, in response to energy needs. Social scientists are interested in the types of people attracted to boomtowns, and what their recreational habits might be.

There are obvious implications for the National Park System, not only because greater population is likely to mean increased visitation, but because these newcomers may differ in composition from the long-term residents of an area and change the complexion of recreational demand.

Are the energy newcomers different? The Cooperative Park Studies Unit at the University of Denver, with support from the Division of Special Science Projects in Washington, sought the answer in three boomtown communities near national parks.

The communities studied were Pinedale and Big Piney in Wyoming, near Yellowstone and Grand Teton, and Watford City in North Dakota, near Theodore Roosevelt National Park. All three locations were booming because of oil development.

Judith Baxter, the primary researcher, visited each of the communities, making ethnographic observations, noting recreational facilities and use, and interviewing town leaders. From a random sample of households, she obtained demographic data and information about respondents' use of parks and recreational facilities and their attitudes about them.

Demographically, newcomers tended to be younger, to have more education, to make more money, to be more likely single or divorced, and to be less attached to the community than the longtimers.

In general, however, the report finds that newcomers and longtimers in all three communities shared similar attitudes and behaviors concerning the national parks in their area. Both groups in all communities shared much in common with the typical park visitor — they like to sightsee, picnic, car tour, and camp, and respondents felt that natural formations, natural forest, wildlife, fresh air, and the chance to be with the family were all very important to their enjoyment of the park.

The report describes major differences, however, pointing out that "newcomers showed high participation rates in very strenuous activities, whereas longtimers favored more passive activities. Newcomers in all communities showed considerably higher rates of hunting and fishing than longtimers. Considerably more newcomers than longtimers find roughing it to be important to their enjoyment of the parks. Greater numbers of newcomers want more camping, fishing, hunting, and backcountry access in the parks. Longtime residents, on the other hand, stress the need for better roads and hotel facilities."

The researchers conclude: "These differences become important in determining variations in park behavior between longtimers and newcomers."

The University of Denver team found that the differences were narrowed, however, if the community had a long history of energy development, or if work schedule and crew arrangements at the site permitted commuting.

The nature of the energy industry, therefore, is an important factor in the leisure time and recreational behavior of workers. As a consequence, the researchers emphasize, the findings from these oil-impacted communities might not apply in areas with other types of energy development.

Most newcomers to the boomtowns studied had visited the nearby national parks. Theodore Roosevelt, only 20 miles from Watford City, experienced the greatest visitation — 77 percent of Watford City's newcomers, in fact, visited the park in the year prior to the study.

Lesser newcomer visitation rates, but still high percentages of respondents, were recorded for Yellowstone and Grand Teton from the Wyoming communities, but Pinedale and Big Piney are at least 70 miles from Grand Teton and 100 miles from Yellowstone.

Other state and federal lands take some of the recreational pressure away from the national parks, as do any well-developed community recreational facilities, although the latter often are dominated by the community's permanent residents, the study revealed.

The University of Denver project points to energy boomtowns' having an important impact on the National Park System, but with just three communities and one industry studied, its conclusions must be limited.

Baxter and project leader Dr. Charles Cortese, an associate professor at the University, have developed a predictive model for the impact of boomtowns on the National Park System, based on the variables discussed. They plan to present the model at upcoming workshops for park managers.

If additional testing proves the model to be valid, social scientists will have a valuable tool for broadening their conclusions. Park managers, in turn, will have a tool which will increase their confidence in decisions facilitating park visitation and protecting valuable park resources.

Carroll is a political scientist with NPS, WASO.

Sparks Abound, Data Sparse At Fire Meeting

by Sarah Greene

It was clear from the outset that the Smoky Bear philosophy of stamping out all fires is, itself, under fire. The symposium and workshop on Wilderness Fire Management Policy, Programs, and Issues in Parks, Wilderness and Other Natural Areas drew more than 600 to Missoula, Mont., the week of Nov. 14-18; federal, state, and private agencies, and universities from the US and Canada were represented.

The idea of prescribed fire to reduce fuels has long been accepted. What land managers now are struggling with is the concept of allowing lightning fires to burn, or of starting fires in certain areas in an effort to mimic the natural lightning fire cycle.

Clearly there is no easy way to do this, especially after more than 80 years of vigorous fire suppression in almost all ecosystems.

Whether the symposium was addressing policy issues, fuels build-up, natural vs. unnatural ignitions, planning, monitoring, operations, or economics, the same set of questions and/or considerations arose. Do we simulate Indian caused fires? Are the Indians a part of the "natural" fire cycle or not, and if so starting when? What is the intrinsic fire return interval? What kinds of natural conditions or processes are we trying to maintain/imitate and for how long? How do we coordinate fires with public use in terms of safety, air quality, and preconceived notions of what constitutes a wilderness experience? How much is reasonable to spend on trying to imitate nature's fire regime? How do we assign a value or even should we, on using fire to maintain healthy ecosystem processes? What kind of and how much monitoring should be done?

All these questions generated discussion in a philosophical vein. The audience generally accepted the concept that fire needs to play a bigger role in wilderness, park and natural area management, but there was little agreement on implementation. This was only reinforced by the dearth of long term data presented at the symposium. Clearly much more needs to be learned – fire histories, baseline information on vegetation patterns and response to fire, fire behavior, how best to monitor, effects on wildlife habitat (an issue that was barely mentioned), etc.

Steve Pyne ended the talks with a historical perspective on wilderness fire. Wilderness fire, in his view, is a recent creation. Fire, a natural process, identifies us as a species. Wilderness, a distinctly American cultural development, identifies us as a particular civilization. He sees the defining relationship as people to fire, not as people to wilderness. He feels it is only a matter of time before this defining relationship is made more clear and accepted. Then, he suggests, wilderness fire will no longer be an issue.

Green is a Research Forester with the USFS Pacific Northwest Experiment Station.

Wilderness Campsites And Trails Considered

Two research papers by David N. Cole, research ecologist with Systems for Environmental Management, Missoula, MT, have been published by USFS Intermountain Forest and Range Experiment Station, Ogden, UT 84401. "Assessing and Monitoring Backcountry Trail Conditions" is Research Paper INT-303; "Monitoring the Condition of Wilderness Campsites" is Research Paper INT-302.

"Assessing and Monitoring" discusses how to apply three types of trail assessment techniques – replicable measurements, rapid surveys, and censuses – and how to use the results to improve backcountry management. "Monitoring" looks at desirable characteristics of a wilderness campsite impact monitoring system, evaluates existing methods, and suggests ways of developing a system that builds on the strong points of existing techniques.

Fire Ecology at Cape Cod and Acadia

By Mary K. Foley

Fire always has been an important natural environmental disturbance factor. It not only alters the physical, chemical and biomass accumulation characteristics of an ecosystem but also directly and indirectly influences the species composition, abundance, and diversity of the plant community. This in turn affects the abundance of wildlife habitats and animal diversity and population dynamics. Yet up until a few years ago the fire management policy throughout the National Park Service was one of total fire suppression. And although natural fire and prescribed fire management practices now are being implemented with increasing frequency Servicewide, total fire suppression is still the standard fire management policy in all North Atlantic Regional Parks.

With the impetus from *Guidelines for the Preparation of Fire Management Plans*, NPS 18, and assistance from our Office of Scientific Studies, several parks in the North Atlantic Region have begun to examine the role of fire in the development of forests, the impact of fire suppression activities on plant community dynamics, and related processes such as fuel accumulation.

The first of these research projects was undertaken via a Cooperative Agreement with the US Forest Service. Dr. William A. Patterson, forest ecologist at the University of Massachusetts-Amherst, his student Karen Saunders, and L. John Horton of the USFS, examined fire regimes for two North Atlantic Region parks, Acadia National Park and Cape Cod National Seashore. They recently completed a report of their findings which have major fire management implications for these areas.

For each area, information on historical fire occurrence, fire weather, fuels and fire-vegetation interactions was collected. They sampled 20-30 stands (5-10 acres each) in dominant vegetation types in each park to provide information on past fire occurrence, plant species composition, and the amount and kind of fuel.

Several methods were used to reconstruct pre-settlement and post-settlement fire histories and associated vegetation changes. Written records plus dendrochronologies were examined to learn where and when fires occurred during the past two centuries (i.e. the post-settlement period). Reconstruction of pre-settlement fire patterns is difficult in areas such as Acadia and Cape Cod where few virgin stands remain. For these earlier times the charcoal and pollen content of sediments from the Bowl, a small deep pond in Acadia NP and Duck Pond in Cape Cod NS were examined to determine if, and how often, fire was present in the pre-settlement forests.

The results of Patterson's pollen and charcoal analyses for the Bowl are summarized in a pollen diagram (Fig. 1). High pollen percentages of agricultural herbs (e.g. *Ambrosia, Rumex,* and GRAMINEAE) at 20-23 cm in the sediment indicated the time of European settlement (1760-1800 A.D.). This date and others were verified by Pb 210 dating. The size of the individual charcoal fragments was estimated and a ratio of charcoal to pollen was used as an indicator of fire activity.

The charcoal profile shows evidence of a fire at about 30 cm, dated at 1550 A.D., and another at 28 cm, dated at 1670 A.D. These indicate a natural fire frequency of approximately 100-200 years. An examination of available climatic records and historic fire records indicate that at Acadia there have been very few lightning-caused fires. This suggests to Patterson that most of these fires were Indian caused. Charcoal sedimentation patterns for Duck Pond also suggests that Indian burning was important in the forest of Cape Cod NS.

Patterson attributes the charcoal peak at the time of settlement (20-23 cm) to land clearing activities and the large increases in charcoal values at 20 cm to widespread post-settlement burning. The Bar Harbor fire of 1947, which burned nearly 30 percent of the parklands on Mt. Desert Island and two-thirds of the Island, is represented in the top of the charcoal profile.

At Acadia, post-settlement forests have created a mostly even-aged red spruce forest. The area burned by the Bar Harbor fire has regenerated to aspen-birch with a dense red spruce understory. The remaining areas are predominantly red spruce of 100-140 years. Although fuel loadings are typically low in most areas of the park, Patterson believes that as these spruce stands mature they will become increasingly susceptible to wind damage. The high fuel loads that result from blowdown will pose a serious fire hazard. It has been estimated that as much as 70 percent of the park is composed of maturing red spruce which will present significant fire management problems in the next 50 years.

Large post-settlement fires and agricultural land use patterns have shaped much of the forest of Cape Cod. Although fuel loadings were found to be generally low, highly flammable huckleberry occupies much of the understory vegetation. Huckleberry, other ericaceous shrubs (with their aromatic oils and low moisture content) and beach grasses pose fire hazards unique to our eastern national seashores.

In both areas fuel accumulation has been identified as the major fire management concern; however, several problems remain to be addressed before a fire management plan, which provides solutions to these problems, can be written and implemented.

For example, as in many national park areas, Acadia and Cape Cod have confusing landownership patterns complicating fire management planning efforts. Although fuels have been identified to be of major concern for both areas, Acadia's complex boundary and scattered parklands and Cape Cod's numerous inholdings would certainly eliminate the implementation of a prescribed natural fire program. Also, in Acadia, island residents remember the 1947 fire too well to be immediately receptive to the need for a fuels reduction or vegetation management program which involved controlled burning. At Cape Cod, too little is known of the effect of fire on huckleberry populations to consider utilizing fire to control them at this time.

There is also the controversial issue of the role of pre-settlement burning in park fire management plans. Although it appears burning by Indians may have been a significant factor in the pre-settlement coastal New England forests, the question of whether such burning should be simulated in park areas, where feasible, has yet to be resolved.

The fire management implications of these studies were presented by Patterson at the Wildfire Symposium, at the University of Montana-Missoula in November and cosponsored by the National Park Service. The reports, *Fire Regimes of the Coastal Maine Forests of Acadia National Park* and *Fire Regimes of Cape Code National Seashore* are available and will be circulated among park science and resource management personnel in the next few weeks.

Foley is an Air Quality Specialist with the North Atlantic Region of NPS.

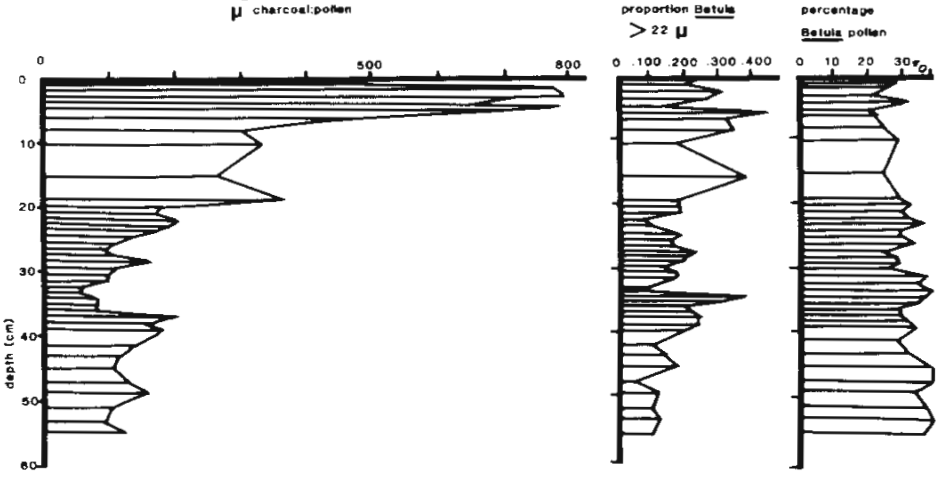

Figure 1

Profiles for charcoal content, proportion of Betula pollen types and total Betula pollen percentages for the the Bowl.

Source: Patterson, Horton and Saunders (1983)

Pest Management: The IPM Approach

By Michael Ruggiero and Gary Johnston

A commitment to sound pest management with a minimal use of chemical pesticides has long existed as an NPS management policy, if not always followed in actual practice. In the past few years the Service has reaffirmed this commitment by implementing the principles and practices of "intergrated pest management" (IPM). These principles, based on sound ecological theory and prescribe methods of pest management, seek to maximize the use of natural controls while minimizing the use of short term chemical treatments. In practice, IPM incorporates monitoring, injury levels, and treatment strategies into an overall decision making process tailored to a particular pest problem at a particular site.

Probably the most important component of a sound IPM program is monitoring. The mere presence of a pest organism does not in itself constitute a pest *problem.* Only through frequent surveys can one determine those pest population densities that may be injurious. The specified injury levels may vary in magnitude with regard to specific management goals. For instance, a park manager may wish to prevent an exotic weed population from establishing new colonies, or reduce burrowing rodent populations to prevent damage to historic structures. Treatment actions generally are taken to restore, preserve, or supplement the checks and balances in the system, not necessarily to eliminate the pest species. Treatment actions should be selected after a thorough review of existing remedies; they should be effective, have minimal environmental impact, and be least threatening to humans. Treatments using preventive, mechanical, cultural, sociological, biological, or chemical means can be used singly or in combination. Monitoring should continue after treatments to determine their effectiveness. The entire process should be evaluated periodically and "fine tuned" as necessary.

Since 1980 the Service has made substantial progress in implementing IPM including: 1) incorporation of IPM principles into Draft Pest Management Guidelines, 2) a more in-depth review of pesticide use proposals at the park, Region and Washington office levels, 3) development of information files on 300 pests and 200 pesticides which are available to the Regions and field, 4) development of a plan for Pesticide Applicator Training and Certification for NPS personnel, 5) completion of a three year pilot project demonstrating IPM principles and practices in the National Capital Region, 6) development of a 40-hour course in Integrated Pest Management for NPS personnel, and 7) completion of workshops on Servicewide pest problems such as, mosquitoes, gypsy moths, urban pests, and agricultural pests.

Reported annual pesticide use declined by approximately 80 percent between 1975 and 1982 (based upon a 1975 figure of 100,000 lbs. used). Although the number of pesticide projects remained constant, the amount of pesticides used per project decreased. The proportionate use of less toxic pesticides (e.g., microbial insecticides, petroleum oil, soap, and boric acid) accounted for 11 percent of the 1982 projects compared to 4 percent in 1979.

The IPM program continues to receive strong NPS support and future plans include increased emphasis on training, the development of IPM information packages, and use of automated equipment to provide the field with easy access to IPM information. One goal for next year is to automate the pesticide approval and reporting process.

Training activities will focus on three areas, the implementation of a 40-hour IPM training course, development of a Pesticide Applicator Certification Training Course, and the scheduling of several workshops on selected Servicewide pest problems. A pilot run of the 40-hour IPM course is scheduled for February 1984 with a second presentation anticipated for July 1984. The Department's Pesticide Applicator Certification Training Course (PACT) has received preliminary review by EPA and is now receiving public comment prior to final action. The target date for full implementation of PACT is 1986, enabling the Service to train and certify its own Pesticide Applicators. Topics of the 1984 workshops include meadow management, structural pest management, exotic/noxious weed management, gypsy moths, and general pest management.

In 1984, a series of IPM informational packages on approximately 20 pests will be prepared. Each package will include information on biology, damage caused by the pest, identification, methods of control, NPS recommended approach to control, professional contacts, and references. This is a continuation of a project initiated in 1983, in which 29 IPM information packages are being prepared and recorded on floppy disks. Electronic copies will be available to the field via telephone/modem. Hard copies of the packages will be available by mail to personnel that do not have access to automated equipment. By 1985 WASO plans to have a completed set of these IPM packages in every park.

Automating the pesticide approval process already has begun on a voluntary basis. Regions that have microprocessing equipment with a modem now are able electronically to transmit the standard "10-21A" pesticide use proposals directly to WASO. Parks with compatible equipment can communicate similarly with the Regions. This procedure can shorten processing time by up to 2 weeks and eliminate the need for costly typing and duplicating services. To date, the WASO CPT microprocessor has successfully interfaced with other CPT, Apple, IBM, and TRS systems, and is thought to be compatible with most microprocessing equipment.

For more information about the IPM program please contact Michael Ruggiero (202-343-7005) or Gary Johnston (202-343-8122) at Biological Resources Division (485), National Park Service, Washington, D.C. 20240.

CRP Survey Takes Systems Approach To Park Problems

A Critical Resource Problems (CRP) Workshop, conducted by the University of Idaho NPS/CPSU on May 16, 1983 in Glacier NP, provided the initial testing ground for a questionnaire to identify problems in the various natural, cultural, and management systems of NPS units, using the Nominal Group Technique (NGT) as the principal workshop process.

The questionnaire, developed by the UI/CPSU, had as a second goal the identification of critical relationships among the various subsystems of Glacier NP and between the park and its surrounding region. The entire area was examined as a system (i.e. as "a grouping of parts, termed components, operating together for a common purpose." This definition comes from J.W. Forrester's 1968 book, *Principles of Systems.*)

As the workshop began, the 10 Glacier NP employees who participated were introduced to the NGT process – a group decision-making technique that has been used extensively in business, industry, and government. As adapted for the Glacier workshop, NGT involved specific identification by the workshop participants of five critical relationships between components of the Glacier NP system (eight components were given at the start). Eventually, the participants were allotted 20 minutes to designate their individual judgments of the 10 most important component relationships that had been identified by the group, and to distribute 100 points among them according to the weight of their importance.

The questionnaire and the NGT functioned in a complementary manner. The questionnaire produced a list of the CRPs, and the workshop produced a ranked listing of critical component relationships that paralleled the findings of the questionnaire.

Support infrastructure, which includes park management and administration, emerged in the workshop as the most important system component. Most of the critical relationships identified between the support infrastructure and other components specifically involved management actions or policies. Recommendations found "a need for improved communication between the administration and the staff managers within the park, and a better understanding of park policies and actions."

A report on the workshop, including an assessment of its strengths and weaknesses, is available from the University of Idaho NPS/CPSU, (College of Forestry), Moscow, ID 83843. The Report, CPSU/UI SB 83-3, is authored by Jonathan P. Kusel (CPSU research assistant), R. Gerald Wright, and Gary E. Machlis, unit leaders.

The questionnaire, revised on the basis of the workshop trial, has been distributed to all NPS areas within the Pacific Northwest Region as the last step in the "pretest" stage. The finalized questionnaire will be submitted to WASO, which provided a portion of the funds for its development.

The Next Two Issues

The Spring issue will focus on Information Management and will include the final installment of the Redwoods story. Dean Simon's Canoveral Fire Project will be in the Summer issue.

Editorial (Continued from page 2)

The seeds were sown, however, for one of the park's thorniest resource management issues long before this impressive array of protective legislation and designations was in place. A letter from Director Arno Cammerer to Chester Thompson, secretary of the Monroe County Fishermen's Assn., dated April 28, 1937, reads: "With this as a background, commercial fishermen using the waters around the Everglades may expect equally fair treatment. The National Park Service has no intention of imposing regulations relating to commercial and sport fishing other than those contained in Florida State laws or county laws in the event that the latter exist." A telegram from Director Newton Drury to Florida Rep. Bernie Papy, dated April 12, 1947, reads: "You are advised that the longtime NPS policy which contemplates that fishing in National Parks and Monuments shall be done in conformity with State laws and regulations subject to reasonable regulations necessary to protect and perpetuate fish resources will apply to Everglades NP in keeping with the commitment of former Director Caruthers to Chester Thompson. Commercial fishing will not be prohibited in the proposed Park."

One final quote will suffice, from a letter dated May 11, 1951, from Director Demeray to Florida's Senator Holland: "You may be assured that we have no intention of deviating from the understanding had between the Department and the State of Florida regarding the continuance of commercial fishing in Park waters. Actually, the commercial fishing regulations recently issued by the Secretary are designed to implement that understanding through regulating these activities so that the marine resources will be preserved and harvested on a sustained yield basis."

Three Directors then, assured Floridians that commercial fishing would not only be allowed in Everglades; one Director went on to promise that the resource would be managed on a sustained yield basis. All of which brings us to *the first of the non-ecological principles* which affect our resource management decisions: The establishment of almost all our Parks was based not only on the significance of the resources but also on a series of implicit and explicit promises made to garner support for the project.

The corollary to this Principle is that the more recently the Park was established, the more promises, agreements, and deals will exist. These arrangements should not be thought of as evil. They are, in fact, a part of the way things get done in the political arena. What is important for our purposes is to (1) recognize that such promises probably exist in our parks and (2) to examine what problems or opportunities they present in relation to our resource management programs.

Ignoring these agreements or wishing they would go away will usually be fatal. As the 1951 letter from Director Demeray stated, the NPS did in fact regulate commercial fishing in several important ways. The inland lakes, bays, canals and rivers were closed to net fishing in 1951 and the remainder of them were closed in 1965, when more area was added to the park. Their closure was to protect coastal and riverine areas and to preserve natural resources. The then superintendent stated that "the entire fisheries resource of Florida Bay has been definitely saved because of these regulations."

The other commercial fishery restriction, established in 1965, limits crab traps to certain waters of the park and distances from any key or marked waterway. These rules were adopted without much protest from commercial fishing interests, probably because there was general agreement among all parties that the fishery resources of Florida Bay were in a state of decline and that the regulations were an attempt to do something about the decline. All of which brings us to our *second non-ecological principle* of resource management: Parties to any agreements will assent to modifications in the agreements *only* when they are convinced that their own interests are thus being served. Arguments as to what will benefit the *resources* of the park will usually prove futile.

The fact is that most of the pre-establishment agreements represent compromises in the way the NPS manages resources. The consumptive use of Everglades NP resources for commercial purpose is, both by tradition and policy, contrary to park purposes. Any attempt to make these agreements more consistent with established resource management principles is very difficult.

In the meantime, in the late 60s and early 70s, the staff at Everglades NP began to hear increasing complaints from long term fishermen that the fishing in Florida Bay just wasn't what is used to be. Between 1972 and 1978, commercial fishing increased an average of 12 percent a year. As the anecdotal reports of the decline in fishery resources in Florida Bay continued to grow, the NPS became convinced that something must be done. Unfortunately, the NPS had no data, except for some creel censuses, to suggest that commercial fishing was the cause of, or the most significant factor in, the decline.

Nevertheless, in January 1979, the Park Service prepared an *Assessment of Fishery Management Options in Everglades National Park, Florida,* widely distributed to commercial and recreational fishing interests. In February, four public workshops were held to solicit public advice and comment and the data gathered were added to the written comments received and analyzed.

In September 1979, proposed regulations were published in the *Federal Register.* Four public hearings were held in October 1979. The proposed regulations were designed to reduce pressures on the fishery resources and reallocate these resources among park wildlife, recreational fishermen, and commercial fishermen. By March 1980, all the regulations were in place. They contain four major provisions:

(1) Commercial fishing will be eliminated by Dec. 31, 1985;

(2) Bag limits are established for all species of fish except mullet and pompano;

(3) Recreational lobster harvest is eliminated;

(4) An 18,000 acre sanctuary is established in NE Florida Bay for protection of crocodiles, which inhabit the area.

All of this brings us to *non-ecological principle No. 3,* which has several corollaries. The principle: Even in this day and age with the attendant emphasis on science, it is possible to make decisions based on philosophical considerations.

Corollary #1: Be sure to say that this is what you are doing. Do not try to hokey up your decision with a lot of non-relevant data. You'll get caught.

Corollary #2: Although Principle No. 3 is possible, you won't get away with it very often. There is no substitute for a well-planned, adequately supported research program in your park, whether it is done by your own people or contracted out.

Corollary #3: Be prepared to be challenged.

The challenge in our "case in point" came shortly after the regulations were published. The Organized Fishermen of Florida, an umbrella group representing the interests of commercial fishermen, filed an emergency motion for a temporary injunction to prohibit the enforcement of the regulations. This motion was denied, based on the Court's observation that (1) there was no likelihood of success on the merits of the case, (2) the NPS had adequately conducted itself as determining "nonsignificance" in not publishing an EIS, and (3) the regulations are a service to the public and the plaintiffs had not demonstrated immediate and irreparable harm.

From April 1980 until November 1980, attorneys for the plaintiffs busied themselves taking depositions from government witnesses. The U.S. Attorney, while monitoring these depositions, continued to be optimistic about the case.

In November 1980, the American people decided that a change was needed in how the country was governed. Which brings us to *non-ecological principle No. 4:* Issues which appear to be settled, based on environmental considerations, can quickly become highly charged political issues. There is only one corollary to this principle: The political friends of the park should be prepared to play a role in the ensuing process.

The Organized Fishermen of Florida, among the first to recognize that the new Administration might wish to review at least some of the decisions of its predecessors, went to Washington, D.C. on April 1, 1981 to meet with Department and Service personnel. At this meeting, the Department agreed that if the Organized Fishermen of Florida would drop the law suit, the NPS would postpone the phaseout of commercial fishing until scientific research could definitely link such fishing with any decline in the fishery resources.

Since the Dec. 31, 1985 date was a Federal regulation, the Department and the Service needed to find a way to announce that a change in the regulation was contemplated. The vehicle chosen was a rule-making petition accepted by the Department from the Organized Fishermen of Florida. The rule-making process is open to interest groups with two provisos:

(1) The petition must seek something that is not statutorily prohibited, and

(2) The action sought must be administratively doable.

In this instance, the *Federal Register* notice was that a 10-day comment period and two public hearings were to be held in the South Florida area.

The public hearings were important. We knew that the friends of the Park would turn out in sufficient numbers to balance the record. Since we believed the existing regulations were important in at least two or three ways (the regs imposed bag limits on recreational fishermen, they eliminated as of Dec. 31, 1985 a use which appeared incompatible with park purposes, and both the above eased pressure on resources so that the park could institute studies to pinpoint the decline in fishery resources), it was incumbent upon us to alert the park supporters to the importance of the public comment period.

The public response was overwhelming:

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Editorial (Continued)

7,531 petition signatures against changing the regulations, 1,675 in favor; 1,269 letters against changing the regs, 225 for; 554 substantive letters against the reg change, eight substantive letters for; 10 agencies and organizations against the change, one in favor; one elected public official against the changes, two in favor; and 9,365 public expressions against, 1,911 for.

On July 26, 1981, the analysis of the public record from the hearings and the comments from the comment period were forwarded to the Regional Director. Shortly after August 1, the analysis was forwarded to the Director. The recommendation from the park, ratified by the Region, was that based on the analysis and our perception of the health of the resources, the regulations should remain in effect.

In late August, that recommendation was forwarded to the Department. After more than an year of "no decision," the Department finally instructed Justice to defend the regulations.

Which brings us to *non-ecological principle No. 5:* No politician is immune to overwhelming expression of public opinion, even if that expression is contrary to what the politician's instincts tell him/her. The one important corollary for our purposes is that the opinion should be based on resource considerations — not an attempt to grind any partisan political axe.

Where does all this take us?

Earlier I referred to Sax and Olmstead and their argument that it is in the National Parks (which Olmstead called "sanctuaries") that visitors become aware of their relationship to our Nation's natural and cultural heritage. I would like to add that in these sanctuaries, the Ranger is the minister, not merely the usher.

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