

AN INTRODUCTION TO

Natural Resources Management

NATIONAL PARK SERVICE
HORACE M. ALBRIGHT TRAINING CENTER

INTRODUCTION TO NATURAL RESOURCES MANAGEMENT

Goal: To better understand natural resources management in the National Park Service and the significance of involvement by all employees.

Program Objectives: At the end of the program, participants will be able to:

1. Define what natural resources are and what the primary goal is in managing them.
2. Identify the natural and man-caused changes that generate resources management programs in parks
3. Describe the practices and identify the policies that have shaped natural resources management in the National Park System.
4. Construct solutions to a resources management problem using a standard problem solving process.
5. List at least 5 ways that he/she can support and contribute to natural resources management programs in their park.

Agenda:

9:00 - 9:15	Introductions, Course Overview, and Pre-Test
9:15 - 9:45	An Introduction to Natural Resources Management
9:45 - 10:30	Ecological Principles
10:30 - 10:45	Break
10:45 - 11:15	Research and Monitoring
11:15 - 12:00	A Look at Laws and Policies
12:00 - 1:00	Lunch
1:00 - 1:30	Solving Problems Through Natural Resources Management
1:30 - 3:15	How Would You Manage Natural Resources? - Case Studies
3:15 - 3:45	How Can You Be Involved?
3:45 - 4:00	Post-Test, Evaluation and Wrap-Up

INTRODUCTION TO NATURAL RESOURCES MANAGEMENT

SESSION OBJECTIVES

Session: Introductions, course overview, and pretest

Objectives: at the end of this session, the participant will be able to:

1. State the objectives of the course.
 2. Identify the 5 major categories of natural resources.
 3. Define, in his/her own words, Natural Resources Management (NRM), and the goal of NRM in the National Park System.
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Session: An Introduction to Natural Resources Management

Objectives:

1. Trace the evolution of NRM in the park system from early years to the 1980's.
 2. State the current objectives of NRM in the National Park System.
 3. Identify at least 7 internal and external influences that have impact upon management of resources in the National Parks.
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Session: Ecological Principles

Objectives:

1. Define the meaning of the term Ecological Principle.
 2. Identify at least five ecological principles and their application to NRM in the National Park System.
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Session: Research and Monitoring

Objectives:

1. State the role of research and monitoring in NRM.
 2. Define Baseline Information.
 3. Define monitoring and identify at least five ways that the NPS conducts monitoring and uses this information.
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Session: A Look at Laws and Policies

Objectives:

1. Identify and describe the impact of some of the laws that guide NPS natural resources management programs.
2. Identify the major policies that guide NPS natural resources management programs.

Session: Solving problems through natural resources management

Objectives:

1. List the steps involved in a problem solving process.
 2. Describe the application of these steps to solving NRM problems in the National Parks.
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Session: How would you manage natural resources? - Case Studies

Objectives:

1. Through case studies, identify at least four major types of resources management problems and strategies to solve them.
-

Session: How can you be involved?

Objectives:

1. List at least two ways that employees in each discipline (maintenance, interpretation, administration, protection) can be involved in NRM.
2. List at least three ways to support and contribute to NRM programs in his/her Park.

EVALUATION

INTRODUCTION TO NATURAL RESOURCES MANAGEMENT

1 = Strongly disagree 5 = Strongly agree

Circle the number that best matches your evaluation:

- | | |
|--|-----------|
| A. I came to this training with high expectations. | 1 2 3 4 5 |
| B. Considering my original expectations, I was highly satisfied with the overall course. | 1 2 3 4 5 |
| C. The goals of the program were appropriate considering my background and duties. | 1 2 3 4 5 |
| C. The program length was sufficient. | 1 2 3 4 5 |
| E. The method(s) of instruction were effective. | 1 2 3 4 5 |
| D. The Program provided useful information. | 1 2 3 4 5 |
| F. This program will help me in my job. | 1 2 3 4 5 |

What are the strong points of the program?

What are the weak points, and how would you improve them?

I would have liked the following included in this course:

This training will help me in my job in the following ways:

Other comments:

INTRODUCTION TO NATURAL RESOURCES MANAGEMENT

PRE-TEST

1. A park's natural resources include not only plants and animals, but also:

_____. These make up ecosystems.
2. What is the goal of natural resources management in natural areas/zones of the Park System today?
3. How might this goal be different in cultural and historical areas/zones?
4. The following ecological principles are either true or false:

T ___ F ___ Communities of plants and animals change only when people or some natural catastrophe, such as a flood or earthquake, interfere.

T ___ F ___ The greater the diversity of living things, the more stable the ecosystem.

T ___ F ___ Nature will respond whenever natural processes are changed.

T ___ F ___ A wide range of tolerance can result in species that are widespread geographically.

T ___ F ___ Nature will lose in the end.
5. Mark True or False:

T ___ F ___ Baseline information is an inventory of the natural resources in a park and their condition.

T ___ F ___ Monitoring helps determine the condition of a resource and documents changes over time.
6. Early NPS resources management practices can best be described as:
(circle correct answers)
 - a. Protection and preservation of natural features.
 - b. Restoration of natural places.
 - c. Perpetuation of ecosystems.
 - d. Elimination of threats to most popular natural attractions.

7. Hunting in parks is permitted only when: (circle correct answer)

- a. Authorized by laws that created the Park.
- b. Authorized by the Director.
- c. Authorized by the Superintendent.
- d. Authorized by laws of the State in which the Park is located.

8. Mark True or False:

T___ F___ Populations of non-native rainbow trout are to be perpetuated wherever fishing for them is a popular recreational activity.

T___ F___ The Superintendent may impose public use limits or close all or a portion of an area when such action is necessary to protect natural resources.

9. The following are necessary steps in any resources management program. Indicate the proper sequence for each of these activities by numbering the blanks:

___ Monitoring and evaluating the results

___ Problem analysis and research

___ Selecting a course of action and implementing a program

___ Identifying alternatives

10. Management of a Park's natural resources is guided by application of ecological principles and certain federal laws. It is also guided and influenced by a variety of other factors; name five that you believe have a substantial impact on NPS resources management programs:

THE LEOPOLD COMMITTEE REPORT - 1963

"AS A PRELIMINARY GOAL, WE WOULD RECOMMEND THAT THE BIOTIC ASSOCIATIONS WITHIN EACH PARK BE MAINTAINED, OR WHERE NECESSARY RECREATED, AS NEARLY AS POSSIBLE IN THE DIRECTION THAT PREVAILED WHEN THE AREA WAS FIRST VISITED BY THE WHITE MAN.

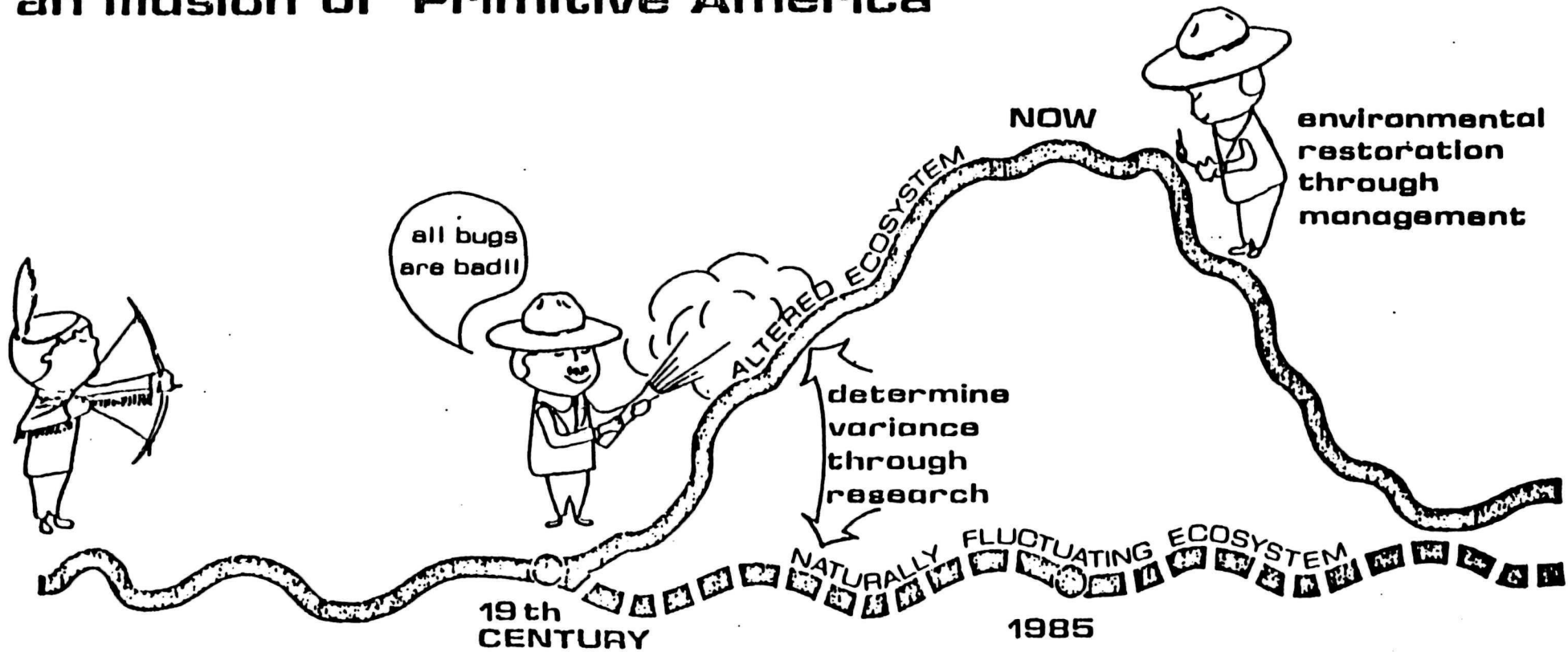
A NATIONAL PARK SHOULD REPRESENT A VIGNETTE OF PRIMITIVE AMERICA.

RESTORING THE PRIMITIVE SCENE IS NOT EASILY DONE NOR CAN IT BE DONE COMPLETELY. YET, IF THE GOAL CANNOT BE FULLY ACHIEVED IT CAN BE APPROACHED.

A REASONABLE ILLUSION OF PRIMITIVE AMERICA COULD BE RECREATED, USING THE UTMOST SKILL, JUDGEMENT, AND ECOLOGICAL SENSITIVITY.

THIS, IN OUR OPINION, SHOULD BE THE OBJECTIVE OF EVERY NATIONAL PARK AND MONUMENT."

Natural Resources Management Goal:
To establish and maintain
an illusion of "Primitive America"





MOTHER BEAR AND CUBS IN GREAT SMOKY MOUNTAINS NATIONAL PARK PHOTOGRAPHED BY FALSTON

Wildlife Management in the National Park

BY AN ADVISORY BOARD: STANLEY A. CAIN, IRA N. GABRIELSON, CLARENCE M. COTTAM, THOMAS L. KIMBALL, AND A. STARKER LEOPOLD, CHAIRMAN

THE Congressional Act of 1916 which created the National Park Service clearly specified preservation of native animal life as one of the purposes of the parks. A frequently quoted passage of the Act states "... which purpose is to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."

In implementing this Act, the newly formed Park Service developed a philosophy of wildlife *protection*, which in that era was indeed the most obvious and immediate need in wildlife conservation. Thus the parks were established as refuges, the animal populations were protected from hunting, and their habitats were protected from wildfire. For a time predators were controlled to protect the "good" animals from the "bad" ones, but this endeavor mercifully ceased in the 1930's. On the whole, there was little major change in the Park Service practice of wildlife management during the first 40 years of its existence.

During the same era, the concept of wildlife management evolved rapidly among other agencies and groups concerned with the production of wildlife for recreational hunting. It is now an accepted truism that maintenance of suitable habitat is the key to sustaining animal populations, and that protection, though it is important, is not of itself a substitute for habitat. Moreover, habitat is not a fixed or stable entity that

can be set aside and preserved behind a fence, like a cliff dwelling or a petrified tree. Biotic communities change through natural stages of succession. They can be changed deliberately through manipulation of plant and animal populations.

In recent years the National Park Service has broadened its concept of wildlife conservation to provide for purposeful management of plant and animal communities as an essential step in preserving wildlife resources "... unimpaired for the enjoyment of future generations." In a few parks active manipulation of habitat is being tested, as for example in the Everglades, where controlled burning is now used experimentally to maintain the open glades and pinelands with their interesting animal and plant life. Excess populations of grazing ungulates are being controlled in a number of parks to preserve the forest plants on which the animals depend.

The question already has been posed: How should the National Park Service go in utilizing its tools of management to maintain wildlife populations?

THE CONCEPT OF PARK MANAGEMENT. The present report proposes to discuss wildlife management in the national parks in terms of three questions which shift emphasis progressively from the general to the specific:

1. What should be the *goals* of wildlife management in the national parks?

ADVISORY BOARD ON WILDLIFE
MANAGEMENT IN NATIONAL PARKS

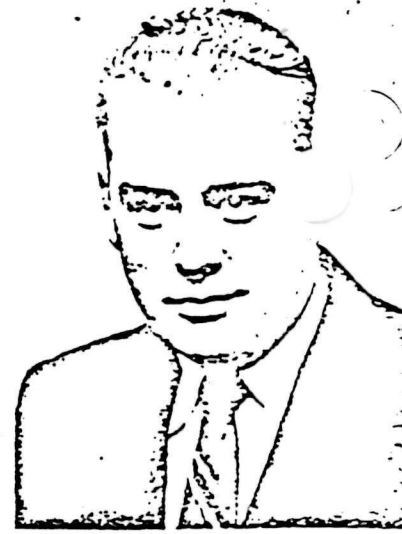


IRA N. GABRIELSON



A. STARKER LEOPOLD, CHAIRMAN

APPOINTED BY SECRETARY OF THE INTERIOR STEWART L. UDALL AFTER YEARS OF DISCUSSION OF PROPOSALS TO USE PUBLIC HUNTING AS AN INSTRUMENT FOR WILDLIFE MANAGEMENT IN NATIONAL PARKS, AN ADVISORY BOARD COMPRISING THE MEMBERS WHOSE PHOTOGRAPHS ARE SHOWN HERE AND, AS A GROUP WITH THE SECRETARY, ON PAGE 20, SUBMITTED ON MARCH 4, 1963, THE REPORT HERE PUBLISHED IN FULL.



THOMAS L. KIMBALL



CLARENCE M. COTTAM



STANLEY A. CAIN

HERE PRESENTED IN FULL is the report submitted on March 4, 1963, to Secretary of the Interior Stewart L. Udall by his special Advisory Board on Wildlife Management.

The report is commented on editorially on page 2 of this issue of *THE LIVING WILDERNESS*.

On pages 20 to 24 of this issue various comments on the report are reported and represented in quotations, in the news item "Leopold Report Appraised."

In submitting the report to Secretary Udall, the Board wrote as follows in a letter of transmission:

"In formulating the conclusions in this report," said the letter, "the Board made a major effort to familiarize itself with actual conditions in the parks and monuments. The full Board visited Yellowstone and Grand Teton National Parks, where the elk situation has been acute. Individual Board members inspected a number of other parks, which in the judgment of the National Park Service have current wildlife problems. Between us in the last few years we have seen nearly all of the major parks and monuments, including those in Hawaii and Alaska. Our recommendations are based principally upon our own knowledge of the parks and their problems.

"Additionally," the Board's letter of transmission continued "we have endeavored to understand and to evaluate the full spectrum of opinions and viewpoints on park management. In September at Jackson Hole the Board met with five directors of state game departments. In December in Washington we met with five executive officers of conservation organizations. Many other individuals and groups have offered advice and information. All of this was informative and helpful, but we want to make clear to you that our conclusions were not reached by weighing opinion and counter-opinions. The conclusions represent our own collective thinking.

"The report is here presented," the Board commented further "is conceptual rather than statistical in approach. We read thousands of pages of reports, documents, and statistical tables but used these data only sparingly to illustrate specific points. Emphasis is placed on the philosophy of park management and the ecologic principles involved. Our suggestions are to enhance the esthetic, historical, and scientific values of to the American public, vis a vis the mass recreational. We sincerely hope that you will find it feasible and appropriate this concept of park values."

skill, imagination, and (we would hopefully suggest) with enthusiasm.

On these areas as elsewhere, the key to wildlife abundance is a favorable habitat. The skills and techniques of habitat manipulation applicable to parks are equally applicable on the recreation areas. The regulation of hunting, on such areas as are deemed appropriate to open for such use, should be in accord with prevailing state regulations.

NEW NATIONAL PARKS. A number of new national parks are under consideration. One of the critical issues in the establishment of new parks will be the manner in which the wildlife resources are to be handled. It is our recommendation that the basic objectives and operating procedures of new parks be identical with those of established parks. It would seem awkward indeed to operate the National Park System under two sets of ground rules. On the other hand, portions of several proposed parks are so firmly established as traditional hunting grounds that impending closure of hunting may preclude public acceptance of park status. In such cases it may be necessary to designate core areas as national parks in every sense of the word, establishing protective buffer zones in the form of national recreation areas where hunting is permitted. Perhaps only through compromises of this sort will the park system be bounded out.

SUMMARY. The goal of managing the national parks and monuments should be to preserve, or where necessary to recreate, the ecologic scene as viewed by the first European visitors. As part of this scene, native species of wild animals should be present in maximum variety and reasonable abundance. Protection alone, which has been the core of Park Service wildlife policy is not adequate to achieve this goal. Habitat manipulation is helpful and often essential to restore or maintain animal numbers. Likewise, populations of the animals themselves must sometimes be regulated to prevent habitat damage; this is especially true of ungulates.

Active management aimed at restoration of natural communities of plants and animals demands skills and knowledge not now in existence. A greatly expanded research program, oriented to management needs, must be developed within the National Park Service itself. Both research and the application of management methods should be in the hands of skilled park personnel.

Insofar as possible, animal populations should be regulated by predation and other natural means.

However, predation cannot be relied upon to control the populations of larger ungulates, which sometimes must be reduced artificially.

Most ungulate populations within the parks migrate seasonally outside the park boundaries where excess numbers can be removed by public hunting. In such circumstances the National Park Service should work closely with state fish and game departments and other interested agencies in conducting the research required for management and in devising cooperative management programs.

Excess game that does not leave a park must be removed. Trapping and transplanting have not been proven practical as a method of control, though providing an appropriate source of breeding stock is needed elsewhere.

Direct removal by killing is the most economical and effective way of regulating ungulates within a park. Game removal by shooting should be conducted under the complete jurisdiction of qualified park personnel and solely for the purpose of reducing animals to preserve park values. Recreational hunting is an inappropriate and non-conforming use of the national parks and monuments.

Most game reduction programs can best be accomplished by regular park employees. But as removal programs increase in size and scope, as well may happen under better wildlife management, the National Park Service may find it advantageous to employ or otherwise engage additional shooters from the general public. No objection to this procedure is foreseen so long as the selection, training, and supervision of shooting crews is under rigid control of the Service and the culling operation is made to conform to primary park goals.

Recreational hunting is a valid and potentially important use of national recreation areas, which are also under the jurisdiction of the National Park Service. Full development of hunting opportunities on these areas should be provided by the National Park Service.

STATEMENT REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, JULY 9, 1946, AND JUNE 11, 1950 (16 STAT. 103), SHOWING THE OWNERSHIP, MANAGEMENT, AND CIRCULATION OF THE LIVING WILDERNESS, PUBLISHED QUARTERLY AT WASHINGTON, D. C.—FOR OCTOBER 1, 1961.

1. The names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, The Wilderness Society, 2144 P Street, N. W., Washington 7, D. C.; Editor, Howard Zahniser, 3115 Mountain Crest Drive, Knoxville 18, Tenn.; Ernest S. Griffith, treasurer, 1941 Parkside Drive, Washington 12, D. C.
2. The owner is The Wilderness Society, an incorporation, non-profit membership organization, not issuing stock: Harvey Browne, president, 3115 Mountain Crest Drive, Knoxville 18, Tenn.; Ernest S. Griffith, treasurer, 1941 Parkside Drive, Washington 12, D. C.
3. The known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are: NONE.

The average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the 12 months preceding the date shown above was: 13,000.

(Signed) HOWARD ZAHNISER.
Sworn to and subscribed before me (this 14th day of October, 1961)
(SEAL) (Signed) CAMILLA S. CHASE
(My commission expires December 13, 1965.)

for the maintenance of buffer zones around the parks where predators are not subject to systematic control, these negotiations have been only partially successful. The effort to protect large predators in and around the parks should be greatly intensified. At the same time, it must be recognized that predators alone can seldom be relied upon to control ungulate numbers, particularly the larger species such as bison, moose, elk, and deer; additional artificial controls frequently are called for.

(b) *Trapping and transplanting.* Traditionally in the past the National Park Service has attempted to dispose of excess ungulates by trapping and transplanting. Since 1892, for example, Yellowstone National Park alone has supplied 10,478 elk for restocking purposes. Many of the elk ranges in the western United States have been restocked from this source. Thousands of deer and lesser numbers of antelope, bighorns, mountain goats, and bison also have been moved from the parks. This program is fully justified so long as breeding stocks are needed. However, most big game ranges of the United States are essentially filled to carrying capacity, and the cost of a continuing program of trapping and transplanting cannot be sustained solely on the basis of controlling populations within the parks. Trapping and handling of a big game animal usually costs from \$50 to \$150 and in some situations much more. Since annual surpluses will be produced indefinitely into the future, it is patently impossible to look upon trapping as a practical plan of disposal.

(c) *Shooting excess animals that migrate outside the parks.* Many park herds are migratory and can be controlled by public hunting outside the park boundaries. Especially is this true in mountain parks, which usually consist largely of summer game range with relatively little winter range. Effective application of this form of control frequently calls for special regulations, since migration usually occurs after normal hunting dates. Most of the western states have cooperated with the National Park Service in scheduling late hunts for the specific purpose of reducing park game herds, and in fact most excess game produced in the parks is so utilized. This is by far the best and the most widely applied method of controlling park populations of ungulates. The only danger is that migratory habits may be eliminated from a herd by differential removal, which would favor survival of non-migratory individuals. With care to preserve, not eliminate, migratory traditions, this plan of control will continue to be the major one of herd regulation in national parks.

(d) *Control by shooting within the parks.* Where other methods of control are inapplicable or impractical, excess park ungulates must be removed by killing.

As stated above in the discussion of park policy, it is the unanimous recommendation of this Board that such shooting be conducted by competent personnel, under the sole jurisdiction of the National Park Service, and for the sole purpose of animal removal, not recreational hunting. If the magnitude of a given removal program requires the services of additional shooters beyond regular Park Service personnel, the selection, employment, training, deputization, and supervision of such additional personnel should be entirely the responsibility of the National Park Service. Only in this manner can the primary goal of wildlife management in the parks be realized. A limited number of expert riflemen, properly equipped and working under centralized direction, can selectively cull a herd with a minimum of disturbance to the surviving animals or to the environment. General public hunting by comparison is often non-selective and grossly disturbing.

Moreover, the numbers of game animals that must be removed annually from the parks by shooting is so small in relation to normally hunted populations outside the parks as to constitute a minor contribution to the public bag, even if it were so utilized. All of these points can be illustrated in the example of the north Yellowstone elk population which has been a focal point of argument about possible public hunting in national parks.

(e) *The case of Yellowstone.* Elk summer in all parts of Yellowstone Park and migrate out in nearly all directions, where they are subject to hunting on adjoining public and private lands. One herd, the so-called Northern Elk Herd, moves only to the vicinity of the park border where it may winter largely inside or outside the park, depending on the severity of the winter. This herd was estimated to number 35,000 animals in 1914, which was far in excess of the carrying capacity of the range. Following a massive die-off in 1919-20 the herd has steadily decreased. Over a period of 27 years, the National Park Service removed 8,825 animals by shooting and 5,765 by live-trapping; concurrently, hunters took 40,745 elk from this herd outside the park. Yet the range continued to deteriorate. In the winter of 1961-62 there were approximately 10,000 elk in the herd and carrying capacity of the winter range was estimated at 5,000. So the National Park Service at last undertook a definitive reduction program, killing 4,283 elk by shooting, which along with 350 animals removed in other ways (hunting outside the park, trapping, winter kill) brought the herd down to 5,725 as censused from helicopter. The carcasses of the elk were carefully processed and distributed to Indian communities throughout Montana and Wyoming; so they were well used. The point at issue is

whether this same reduction could or should have been accomplished by public hunting.

In autumn during normal hunting season the elk are widely scattered through rough inaccessible mountains in the park. Comparable areas, well stocked with elk, are heavily hunted in adjoining national forests. Applying the kill statistics from the forests to the park, a kill of 200-400 elk might be achieved if most of the available pack stock in the area were used to transport hunters within the park. Autumn hunting could not have accomplished the necessary reduction.

In mid-winter when deep snow and bitter cold forced the elk into lower country along the north border of the park, the National Park Service undertook its reduction program. With snow vehicles, trucks, and helicopters they accomplished the unpleasant job in temperatures that went as low as -40° F. Public hunting was out of the question. Thus, in the case most bitterly argued in the press and in legislative halls, reduction of the herd by recreational hunting would have been a practical impossibility, even if it had been in full conformance with park management objectives.

From now on, the annual removal from this herd may be in the neighborhood of 1,000 to 1,800 head. By January 31, 1963, removals had totalled 1,300 (300 shot outside the park by hunters, 600 trapped and shipped, and 406 killed by park rangers). Continued special hunts in Montana and other forms of removal will yield the desired reduction by spring. The required yearly maintenance kill is not a large operation when one considers that approximately 100,000 head of big game are taken annually by hunters in Wyoming and Montana.

(f) *Game control in other parks.* In 1961-62, excluding Yellowstone elk, there were approximately 870 native animals transplanted and 827 killed on 18 national parks and monuments. Additionally, about 2,500 feral goats, pigs, and burros were removed from three areas. Animal control in the park system as a whole is still a small operation.

It should be emphasized, however, that removal programs have not in the past been adequate to control ungulates in many of the parks. Future removals will have to be larger and in many cases repeated annually. Better management of wildlife habitat will naturally produce larger annual surpluses. But the scope of this phase of park operation will never be such as to constitute a large facet of management.

On the whole, reductions will be small in relation to game harvests outside the parks. For example, from 50 to 200 deer a year are removed from a problem area in Sequoia National Park; the deer kill in

California is 75,000 and should be much larger. Rocky Mountain National Park 59 elk were removed in 1961-62 and the trim should perhaps be 100 per year in the future; Colorado kills over 10,000 elk per year on open hunting ranges. In part, this relates to the small area of the National Park which constitutes only 3.9 per cent of the main; hunting ranges under the jurisdiction of the Forest Service and Bureau of Land Management make up approximately 70 per cent.

In summary, control of animal populations in national parks would appear to us to be an integral part of park management, best handled by the National Park Service itself. In this manner ungulates have been controlled in the national parks of Canada since 1943, and the same principle is being applied in the parks of many African countries. Selection of personnel to do the shooting likewise is a function of the Park Service. In most small operations this would logically mean skilled rangers. In larger removal programs, there might be included additional personnel, selected from the general public, hired and deputized by the Service or otherwise engaged, but with a view to accomplishing a task under strict supervision and solely for the protection of park values. Examples of some potentially large removal programs where expanded crews may be needed are mule deer populations on plateaus fringing Dinosaur National Monument and Zion National Park (west side), and white-tailed deer in

WILDLIFE MANAGEMENT ON NATIONAL RECREATION AREAS. By precedent and logic, the management of wildlife resources on national recreation areas can be viewed in a very different light than in the park system proper.

National recreation areas are by definition multiple use in character as regards allowable types of recreation. Wildlife management can be incorporated into the operational plans of these areas with public hunting as one objective. Obviously, hunting must be regulated in time and place to minimize conflict with other uses, but it would be a mistake for the National Park Service to be unduly restrictive of legitimate hunting in these areas.

Most of the existing national recreation areas are federal holdings surrounding large water impoundments; there is little potentiality for hunting. The national seashore recreational areas on the East Coast (Hatteras, Cape Cod, Padre Island) offer limited waterfowl shooting. But some of the new areas being acquired or proposed for acquisition will offer substantial hunting opportunity for a variety of species. This opportunity should be developed.

who climbs a volcano in Hawaii ought to see mamane trees and silver-swords, not goats.

Carrying this point further, observable artificiality in any form must be minimized and obscured in every possible way.

Wildlife should not be displayed in fenced enclosures; this is the function of a zoo, not a national park. In the same category is artificial feeding of wildlife. Fed bears become bums, and dangerous. Fed elk deplete natural ranges. Forage relationships in wild animals should be natural.

Management may at times call for the use of the tractor, chain-saw, rifle, or flame-thrower, but the signs and sounds of such activity should be hidden from visitors insofar as possible.

In this regard, perhaps the most dangerous tool of all is the roadgrader. Although the American public demands automotive access to the parks, road systems must be rigidly prescribed as to extent and design.

Roadless wilderness areas should be permanently zoned.

The goal, we repeat, is to maintain or create the mood of wild America. We are speaking here of restoring wildlife to enhance this mood, but the whole effect can be lost if the parks are overdeveloped for motorized travel.

If too many tourists crowd the roadways, then we should ration the tourists rather than expand the roadways.

Additionally in this connection, it seems incongruous that there should exist in the national parks mass-recreation facilities such as golf courses, ski lifts, motorboat marinas, and other extraneous developments which completely contradict the management goal. We urge the National Park Service to reverse its policy of permitting these nonconforming uses, and to liquidate them as expeditiously as possible (painful as this will be to concessionaries).

Above all other policies, the maintenance of naturalness should prevail.

Another major policy concerns the research which must form the basis for all management programs.

The agency best fitted to study park management problems is the National Park Service itself. Much help and guidance can be obtained from ecologic research conducted by other agencies, but the objectives of park management are so different from those of state fish and game departments, the Forest Service, etc., as to demand highly skilled studies of a very specialized nature.

Management without knowledge would be a dangerous policy indeed. Most of the research now conducted by the National Park Service is oriented largely to interpretive functions rather than to manage-

ment. We urge the expansion of the research activity in the Service to prepare for future management and restoration programs.

As models of the type of investigation that should be greatly accelerated we cite some of the recent studies of elk in Yellowstone and of bighorn sheep in Death Valley. Additionally, however, there are needed equally critical appraisals of ecologic relationships in various plant associations and of many less organisms such as azaleas, lupines, chipmunks, tortoises, and other non-economic species.

In consonance with the above policy statements, it follows logically that every phase of management itself be under the full jurisdiction of biological trained personnel of the Park Service. This applies not only to habitat manipulation but to all facets of regulating animal populations. Reducing the numbers of elk in Yellowstone or of goats on Haleakala Crater is part of an overall scheme to preserve or restore a natural biotic scene.

The purpose is single-minded. We cannot endorse the view that responsibility for removing excess game animals be shared with state fish and game departments whose primary interest would be to capitalize on the recreational value of the public hunting that could thus be supplied. Such a proposal impugns the multiple use concept of park management which was never intended, which is not legally permitted, and for which can we find any impelling justification.

Purely from the standpoint of how best to achieve the goal of park management, as here defined, unilateral administration directed to a single objective is obviously superior to divided responsibility, in which secondary goals, such as recreational hunting, are introduced.

Additionally, uncontrolled public hunting might well operate in opposition to the goal by removing roadside animals and frightening the survivors, the end that public viewing of wildlife would be materially impaired.

In one national park, namely Grand Teton, public hunting was specified by Congress as the method to be used in controlling elk. Extended trial suggests this to be an awkward administrative tool at best.

Since this whole matter is of particular current interest it will be elaborated in a subsequent section on methods.

METHODS OF HABITAT MANAGEMENT. It is obviously impossible to mention in this report all the possible techniques that might be used by the National Park Service in manipulating plant and animal populations. We can, however, single out a few examples.

In so doing, it should be kept in mind that the total area of any one park, or of the parks collectively, that may be managed intensively is a very modest part indeed. This is so for two reasons.

First, critical areas which may determine animal abundance are often a small fraction of total range. One deer study on the west slope of the Sierra Nevada, for example, showed that important winter range, which could be manipulated to support the deer, constituted less than two per cent of the year-long herd range. Roadside areas that might be managed to display a more varied and natural flora and fauna can be rather narrow strips. Intensive management, in short, need not be extensive to be effective.

Secondly, manipulation of vegetation is often exorbitantly expensive. Especially will this be true when the objective is to manage "invisibly"—that is, to conceal the signs of management. Controlled burning is the only method that may have extensive application.

The first step in park management is historical research, to ascertain as accurately as possible what plants and animals and biotic associations existed originally in each locality. Much of this has been done already.

A second step should be ecologic research on plant-animal relationships leading to formulation of a management hypothesis.

Next should come small-scale experimentation to test the hypothesis in practice. Experimental plots can be situated out of sight of roads and visitor centers.

Lastly, application of tested management methods can be undertaken on critical areas.

By this process of study and pre-testing, mistakes can be minimized. Likewise, public groups vitally interested in park management can be shown the results of research and testing before general application, thereby eliminating possible misunderstanding and friction.

Some management methods now in use by the National Park Service seem to us potentially dangerous. For example, we wish to raise a serious question about the mass application of insecticides in the control of forest insects. Such application may (or may not) be justified in commercial timber stands, but in a national park the ecologic impact can have unanticipated effects on the biotic community that might defeat the overall management objective. It would seem wise to curtail this activity, at least until research and small-scale testing have been conducted.

Of the various methods of manipulating vegetation, the controlled use of fire is the most "natural" and much the cheapest and easiest to apply. Unfortunately, however, forest and chaparral areas that

have been completely protected from fire for long periods may require careful advance treatment before even the first experimental blaze is set. Trees and mature brush may have to be cut, piled, and burned before a creeping ground fire can be conducted safely and at low expense. On the other hand, some situations may call for a hot burn. On Isle Royale, moose range is created by periodic holocausts that open the forest canopy. Maintenance of the moose population is surely one goal of management on Isle Royale.

Other situations may call for the use of the bulldozer, the disc harrow, or the spring-tooth harrow to initiate desirable changes in plant succession. Buffalo wallows on the American prairies were the propagation sites of a host of native flowers and forbs that fed the antelope and the prairie chicken. In the absence of the great herds, wallows can be simulated.

Artificial reintroduction of rare native plants is often feasible. Overgrazing in years past led to local extermination of many delicate perennials, such as some of the orchids. Where these are not reappearing naturally they can be transplanted or cultured in a nursery. A native plant, however small and inconspicuous, is as much a part of the biota as a redwood tree or a forage species for elk.

In essence, we are calling for a set of ecologic techniques unknown in this country today. America has shown a great capacity for degrading and destroying native biotas. So far we have not exercised much imagination or ingenuity in rebuilding damaged biotas. It will not be done by passive protection alone.

CONTROL OF ANIMAL POPULATIONS. Good park management requires that ungulate populations be reduced to the level that the range will carry in good health and without impairment to the soil, the vegetation, or to habitats of other animals. This problem is world-wide in scope and includes non-park as well as park lands. Balance may be achieved in several ways.

(a) *Natural predation.* Insofar as possible, control through natural predation should be encouraged. Predators are now protected in the parks of the United States, although unfortunately they were not in the early years and the wolf, grizzly bear, and mountain lion became extinct in many of the national parks. Even today populations of large predators where they still occur in the parks, are kept at an optimal level by programs of predator control applied outside the park boundaries. Although the National Park Service has attempted to negotiate control agencies of federal and local government

2. What general *policies* of management are best adapted to achieve the pre-determined goals?

3. What are some of the *methods* suitable for on-ground implementation of policies?

It is acknowledged that this Advisory Board was requested by the Secretary of the Interior to consider particularly one of the methods of management; namely, the procedure of removing excess ungulates from some of the parks. We feel that this specific question can only be viewed objectively in light of goals and operational policies, and our report is framed accordingly.

In speaking of national parks we refer to the whole system of parks and monuments; national recreation areas are discussed briefly near the end of the report.

As a prelude to presenting our thoughts on the goals, policies, and methods of managing wildlife in the parks of the United States we wish to quote in full a brief report on "Management of National Parks and Equivalent Areas" formulated by a committee of the First World Conference on National Parks that convened in Seattle in July, 1962. The committee consisted of 15 members of the conference, representing eight nations; the chairman was Francois Bourliere of France. In our judgment this report suggests a firm basis for park management. The statement of the committee follows:

1. Management is defined as any activity directed toward achieving or maintaining a given condition in plant and/or animal populations and/or habitats in accordance with the conservation plan for the area. A prior definition of the purposes and objectives of each park is assumed.

Management may involve active manipulation of the plant and animal communities, or protection from modification or external influences.

2. Few of the world's parks are large enough to be in fact self-regulatory ecological units; rather, most are ecological islands subject to direct or indirect modification by activities and conditions in the surrounding areas. These influences may involve such factors as immigration and/or emigration of animal and plant life, changes in the fire regime, and alterations in the surface or subsurface water.

3. There is no need for active modification to maintain large examples of the relatively stable "climax" communities which under protection perpetuate themselves indefinitely. Examples of such communities include large tracts of undisturbed rain-forest, tropical mountain paramos, and arctic tundra.

4. However, most biotic communities are in a constant state of change due to natural or man-caused processes of ecological succession. In these "successional" communities it is necessary to manage the habitat to achieve or stabilize at a desired stage. For example, fire is an essential management tool to maintain East African open savanna or American prairie.

5. Where animal populations get out of balance with their habitat and threaten the continued existence of a desired en-

vironment, population control becomes essential. This principle applies, for example, in situations where ungulate populations have exceeded the carrying capacity of their habitat through loss of predators, immigration from surrounding areas, or compression of normal migratory patterns. Specific examples include excess populations of elephants in some African parks and ungulates in some mountain parks.

6. The need for management, the feasibility of management methods, and evaluation of results must be based upon current and continuing scientific research. Both the research and management itself should be undertaken only by qualified personnel. Research, management planning, and execution must take into account, and, if necessary, regulate, the human uses for which the park is intended.

7. Management based on scientific research is, therefore, not only desirable but often essential to maintain some biotic communities in accordance with the conservation plan of national park or equivalent area.

THE GOAL OF PARK MANAGEMENT IN THE UNITED STATES. Item 1 in the report just quoted specifies that "a prior definition of the purposes and objectives of each park is assumed." In other words, the goal must first be defined.

As a primary goal, we would recommend that the biotic associations within each park be maintained, or where necessary recreated, as nearly as possible in the condition that prevailed when the area was first visited by the white men. A national park should represent a vignette of primitive America.

The implications of this seemingly simple aspiration are stupendous. Many of our national parks—in fact most of them—went through periods of indiscriminate logging, burning, livestock grazing, hunting, and predator control. Then they entered the park system and shifted abruptly to a regime of equally unnatural protection from lightning fires, from insect outbreaks, absence of natural controls of ungulates, and in some areas elimination of normal fluctuations in water levels. Exotic vertebrates, insects, plants, and plant diseases have inadvertently been introduced. And of course lastly there is the factor of human use—of roads and trampling and camp ground and pack stock. The resultant biotic associations in many of our parks are artifacts, pure and simple. They represent a complex ecologic history but do not necessarily represent primitive America.

Restoring the primitive scene is not done easily nor can it be done completely. Some species are extinct. Given time, an eastern hardwood forest can be regrown to maturity, but the chestnut will be missing, and so will the roar of pigeon wings. The colorful drapanid finches are not to be heard again in the lowland forests of Hawaii, nor will the jack-hammer of the ivory-bill ring in southern swamps. The wol-

and grizzly bear cannot readily be reintroduced into ranching communities, and the factor of human use of the parks is subject only to regulation, not elimination. Exotic plants, animals, and diseases are here to stay.

All these limitations we fully realize. Yet, if the goal cannot be fully achieved it can be approached. A reasonable illusion of primitive America could be recreated, using the utmost in skill, judgment, and ecologic sensitivity. This in our opinion should be the objective of every national park and monument.

To illustrate the goal more specifically, let us cite some cases. A visitor entering Grand Teton National Park, Wyoming, from the south drives across Antelope Flats. But there are no antelope. No one seems to be asking the question—why aren't there? If the mountain men who gathered here in rendezvous fed their squaws on antelope, a 20th century tourist at least should be able to see a band of these animals. Finding out what aspect of the range needs rectifying, and doing so, would appear to be a primary function of park management.

When the Forty-niners poured over the Sierra Nevada into California, those that kept diaries wrote almost to a man of the wide-spaced columns of mature trees that grew on the lower western slope in gigantic magnificence. The ground was a grass parkland, in springtime carpeted with wildflowers. Deer and bears were abundant.

Today much of the west slope is a dog-hair thicket of young pines, white fir, incense cedar, and mature brush—a direct function of overprotection from natural ground fires. Within the four national parks—Lassen, Yosemite, Sequoia, and Kings Canyon—the thickets are even more impenetrable than elsewhere. Not only is this accumulation of fuel dangerous to the giant sequoias and other mature trees, but the animal life is meager, wildflowers are sparse, and to some at least the vegetative tangle is depressing, not uplifting.

Is it possible that the primitive open forest could be restored, at least on a local scale? And if so, how?

We cannot offer an answer. But we are posing a question to which there should be an answer of immense concern to the National Park Service.

The scarcity of bighorn sheep in the Sierra Nevada represents another type of management problem. Though the bighorns have been effectively protected for nearly half a century, there are fewer than 400 in the Sierra. Two-thirds of them are found in summer along the crest which lies within the eastern border of Sequoia and Kings Canyon National Parks. Obviously, there is some shortcoming of habitat that precludes further increase in the population.

The high country is still recovering slowly from

the devastation of early domestic-sheep grazing graphically described by John Muir. But the present limitation may not be in the high summer range, all but rather along the eastern slope of the Sierras where the bighorns winter on lands in the jurisdiction of the Forest Service. These areas are grazed in summer by domestic livestock and large mule deer, and it is possible that such competition is adversely affecting the bighorns.

It would seem to us that the National Park Service might well take the lead in studying this problem and in formulating cooperative management plans with other agencies, even though the management problem lies outside the park boundary.

The goal, after all, is to restore the Sierra bighorn. If restoration is achieved in the Sequoia-Kings Canyon region, there might follow a program of reintroduction and restoration of bighorns in Yosemite and Lassen National Parks, and Lava Beds National Monument, within which areas this magnificent native animal is presently extinct.

We hope that these examples clarify what we mean by the goal of park management.

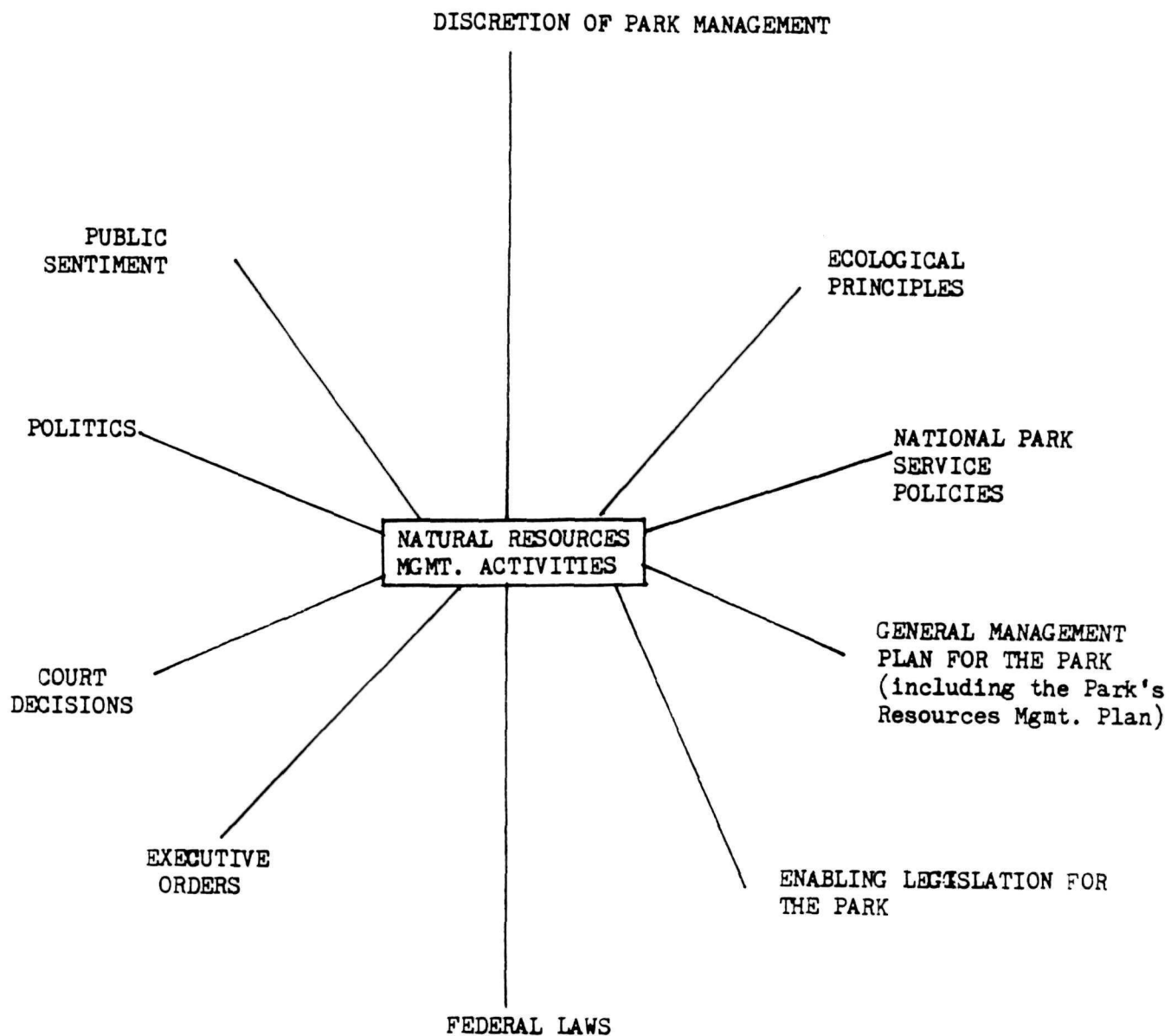
POLICIES OF PARK MANAGEMENT. The major policy change which we would recommend to the National Park Service is that it recognize the enormous complexity of ecologic communities and the diverse management procedures required to preserve them.

The traditional, simple formula of protection can be exactly what is needed to maintain such climax associations as arctic-alpine heath, the rain forests of the Olympic peninsula, or the Joshua trees and saguaro of southwestern deserts. On the other hand, grasslands, savannas, aspen, and other successional shrub and tree associations may call for very different treatment.

Reluctance to undertake biotic management can never lead to a realistic presentation of primitive America, much of which supported successional communities that were maintained by fires, floods, hurricanes, and other natural forces.

A second statement of policy that we would recommend—and this one conforms with present National Park Service standards—is that management be limited to native plants and animals.

Exotics have intruded into nearly all of the parks but they need not be encouraged, even those that have interest or ecologic values of their own. Restoration of antelope in Jackson Hole, for example, should be done by managing native forage plants, not by sowing crested wheat grass or plots of irrigated Gambel quail in a desert wash should be under the shade of a mesquite, not a tamarisk. A visitor



Million-Year Histories

Species Diversity as an Ethical Goal

BY EDWARD O. WILSON

They are best seen not on foot or from outer space but through the window of an airplane: the newly cleared lands, the expanding web of roads and settlements, the inexplicable plumes of smoke, and the shrinking enclaves of natural habitat. In a glance we are reminded that the once mighty wilderness has shriveled into timber leases and threatened nature reserves. We measure it in hectares and count the species it contains, knowing that each day something vital is slipping another notch down the ratchet, a million year history is fading from sight.

The loss of wilderness conforms to the original Greek concept of tragedy because it reveals in grave and somber manner the inexorable workings of the human condition. It presents us with a dilemma that the historian Leo Marx has called the machine in the garden. On the one hand the natural world is the refuge of the spirit, remote, static, richer even than human imagination. But on the other hand we cannot exist in this paradise without the machine that tears it apart. We are killing the thing we love, our Eden, progenitrix and sibyl.

Human beings are not natural creatures torn from a sylvan niche and imprisoned within a world of artifacts. The noble savage, a biological impossibility, never existed. The human relation to nature is vastly more subtle and irretrievably ambivalent, for what appears to be the following reason. Over thousands of generations the mind evolved within a ripening culture, creating itself out of symbols and tools, and genetic advantage accrued from planned modifications of the environment. The unique operations of the brain are the result of natural selection operating through the filter of culture. They have suspended us between the two antipodal ideals of nature and machine, forest and city, the natural and the artifactual, relentlessly seeking, in the words of the geographer Yi-Fu Tuan, an equilibrium not of this world.

The impossible dilemma caused no problem for ancestral humans. For millions of years human beings simply went at nature with everything they had, scrounging food and fighting off predators across a known world of but a few square miles. Life was short, fate terrifying, and reproduction an urgent priority: children, if freely conceived, could just about replace the family members who

seemed to be dying all the time. The population flickered around equilibrium, and sometimes whole bands became extinct. Nature was something out there—nameless, unconfined, and limitless, a force to beat against, cajole, and exploit.

If the machine gave no quarter, then it was also too weak to break the wilderness. But no matter: the ambiguity of the opposing ideals was a superb strategy for survival, so long as the people who used it stayed sufficiently ignorant. It enhanced the genetic evolution of the brain and generated more and better culture. The world began to yield, first to the agriculturists and then to technicians, merchants, and circumnavigators. Humanity accelerated toward the machine antipode, heedless of the natural desire of the mind to keep the opposite as well. Now we are near the end. The inner voice murmurs *you went too far* and disturbed the world and gave away too much for your control of nature. Perhaps Hobbes' definition is correct and this will be the hell we earned for realizing truth too late.

But it is not too late: the actors have not yet left the stage of this particular tragedy. The course of the future can be changed with sufficient knowledge and a strong enough commitment shared by enough people. Like many scientists concerned with the problem, I have emphasized two aspects I consider vital to the development of a better conservation ethic: the appreciation of the vastness of the species diversity that is endangered by the loss of wilderness and the lesser natural reserves, and a fuller understanding of the dependence people feel on other forms of life. Let us begin with the first.

Think of scooping up a handful of soil and leaf litter and spreading it out on a white ground cloth, in the manner of the field biologist, for close examination. This unprepossessing lump contains more order and richness of structure, and particularity of history, than the entire surface of all the other planets combined. It is a miniature wilderness that can take almost forever to explore.

Tease apart the adhesive grains with the aid of forceps, and you will expose the tangled rootlets of a flowering plant, curling around the rotting veins of humus, and perhaps some larger object such as the boat-shaped husk of a seed. Almost certainly among them will be a scattering

of creatures that measure the world in millimeters and treat this soil sample as traversable: ants, spiders, spring-tails, armored oribatid mites, enchytraeid worms, millipedes. With the aid of a dissecting microscope now proceed on down the size scale to the roundworms, a world of scavengers and fanged predators feeding on them. In the hand-held microcosm all of these creatures are still giants in a relative sense. The organisms of greatest diversity and numbers are invisible or nearly so. When the soil-and-litter clump is progressively magnified, first with a compound light microscope and then with scanning electron micrographs, specks of dead leaf expand into mountain ranges and canyons, and soil particles become heaps of boulders. A droplet of moisture trapped between root hairs grows into an underground lake, surrounded by a three-dimensional swamp of moistened humus. The niches are defined by both topography and nuances in chemistry, light, and temperature shifting across fractions of a millimeter. Organisms for which the soil sample is a complete world, now come into view. In certain places are found the fungi: cellular slime molds, the one-celled chitin-producing chytrids, minute gonapodyaceous and oomycete soils specialists, Kickxellales, Eccrinales, Endomycetales, and Zoopagales. Contrary to their popular reputation, the fungi are not formless blobs, but exquisitely structured organisms with elaborate life cycles worthy of their exotic titles.

Still smaller than the parasitic fungi are the bacteria, including colony-forming polyangiaceous species, specialized predators that consume other bacteria. All around them live rich mixtures of rods, cocci, coryneforms, and slime azotobacteria. Together these microorganisms metabolize the entire spectrum of live and dead tissue. At the moment of discovery some are actively growing and fissioning, while others lie dormant in wait for the right combination of nutrient chemicals. Each species is kept at equilibrium by the harshness of the environment. Any one, if allowed to expand without restriction for a few weeks, would multiply exponentially, faster and faster, until it weighed more than the entire earth. But in reality the individual organism simply dissolves and assimilates whatever appropriate fragments of plant and animal that come to rest near it. If the new-found meal is large enough, it may succeed in growing and reproducing briefly before receding back into the more normal state of physiological quiescence.

In other words, biologists have begun a reconnaissance into a land of magical names. In exploring life they have commenced a pioneering adventure with no imaginable end. The abundance of organisms increases downward by level, like layers in a pyramid. The handful of soil and litter is home for hundreds of insects, nematode worms, and other larger creatures, about 1 million fungi, and 10 billion bacteria. Each of the species of these organisms has a distinct life cycle fitted to the portion of the microenvironment in which it thrives and reproduces. The particularity is due to the fact that it is programmed by an exact sequence of nucleotides, the ultimate molecular unit.

The amount of information in the sequence can be measured in bits in the following way. One bit is the information required to determine which of two equally likely alternatives is chosen, such as heads or tails in a coin toss. The English language averages two bits per letter. A single bacterium possesses about 10 million bits of genetic information, a fungus 1 billion, and an insect from 1 to 10 billion bits according to species. If the information in just one insect—say an ant or beetle—were to be translated into a code of English words and printed in letters of standard size, the string would stretch over 1,000 miles. The lump of earth contains information that would fill all fifteen editions of the *Encyclopaedia Britannica*.

I invite you now to try to visualize the loss in biological diversity due to the reduction of natural habitats. If so much complexity of information can be held in the cupped hands, think of how much more exists in an entire habitat. Consider the loss, mostly invisible to us today but destined to be painfully obvious to our descendants, that occurs when an entire wilderness area is degraded or destroyed.

It is an issue that turns otherwise cautious scientists into outspoken activists. On a worldwide basis, extinction is accelerating and could reach ruinous proportions during the next twenty years. Not just birds and mammals are vanishing but such smaller forms as mosses, insects, and minnows. A conservative estimate of the current extinction rate is 1,000 species a year, mostly because of the destruction of forests and other key habitats in the tropics. By the 1990s, the figure is expected to rise past 10,000 species a year (one species per hour). During the next thirty years, fully 1 million species could be erased.

Whatever the exact figure—and the primitive state of evolutionary biology permits us only to set broad limits—the current rate is at least the greatest in recent geological history. It is also much higher than the rate of production of new species by ongoing evolutionary processes, so that the net result is a steep decline in global biological diversity. Whole categories of organisms that emerged over the past 10 million years, among them the familiar condors, rhinoceros, manatees, and gorillas, are close to the end. For most of their species, the last individuals to exist in the wild state could well be those living there today. It is a grave error to dismiss the hemorrhaging as a "Darwinian" process, in which species autonomously come and go and humans are just the latest burden on the environment. Human destructiveness is something new under the sun. Perhaps it is matched by the giant meteorites thought to smash into the earth and darken the atmosphere every 100 million years or so (the last one apparently arrived 65 million years ago and contributed to the extinction of the dinosaurs). But even that interval is 10,000 times longer than the entire history of civilization. In our own brief lifetime humanity will suffer an incomparable loss in aesthetic value, practical benefits from biological research, and worldwide biological stability. Deep mines of biological diversity will have been dug out and carelessly discarded in the course of environmental exploitation, out our even knowing fully what they contained.

These calculations lend great importance to the National Wilderness Preservation System in our own country and underscore the need to both enlarge and strengthen it. The 1964 Wilderness Act that created the program is sound in philosophy, but its implementation thus far falls grievously short of protecting the American heritage of living diversity. Of the 233 distinct ecosystems recognized by the Forest Service in the United States and Puerto Rico, only 81 are represented in the National Wilderness Preservation System. Another 102 ecosystems could be set aside within the domain of federally owned undeveloped lands.

In the end, the problem of wilderness preservation is a moral issue, for us and for our descendants. It is a curious fact that when very little is known about a subject, the important questions people raise are ethical. Then as knowledge grows, they become more concerned with information than with morality, in other words more narrowly intellectual. Finally, as understanding becomes sufficiently complete, the questions turn ethical again. Environmentalism is now passing from the first to the second phase, and there is reason to hope that it will proceed directly on to the third.

The future of the conservation movement depends on such an advance in moral reasoning. Its maturation is linked to that of biology and a new hybrid field, bioethics, that deals with the many technological advances recently made possible by biology. Philosophers and scientists are applying a more formal analysis to such complex and difficult problems as the allocations of scarce organ transplants, heroic but extremely expensive efforts to prolong life, and the possible use of genetic engineering to alter human heredity. They have only begun to consider the relationships between human beings and organisms with the same rigor. It is clear that the key to precision lies in the understanding of motivation, the ultimate reasons why people care about one thing but not another—why, for example, they prefer a city with a park to a city alone. The goal is to join emotion with the rational analysis of emotion in order to create a deeper and more enduring conservation ethic.

Aldo Leopold, the pioneer ecologist and author of *Sand County Almanac*, defined an ethic as a set of rules invented to meet circumstances so new or intricate, or else encompassing responses so far in the future, that the average person cannot foresee the final outcome. What is good for you and me at this moment might easily sour within ten years, and what seems ideal for the next few decades could ruin future generations. That is why any ethic worthy of the name has to encompass the distant future. The relationships of ecology and the human mind are too intricate to be understood entirely by unaided intuition, by common sense—that overrated capacity defined by Einstein as the set of prejudices we acquire by the age of eighteen.

An enduring code of ethics is not created whole from absolute premises but inductively, in the manner of common law, with the aid of case histories, by feeling and

consensus, through an expansion of knowledge and experience, influenced by an understanding of human needs and mental development, during which well-meaning and responsible people sift the opportunities and come to agree upon norms and directions.

Why then should the human race protect biological diversity? Let me count the ways. The first is that we are part of life on earth, share its history, and hence should hesitate before degrading and destroying it. The acceptance of this principle does not diminish humanity but raises the status of nonhuman creatures. We should at least pause and give reason before treating them as disposable matter. Peter Singer, a philosopher and animal liberationist, has gone so far as to propose that the circle of altruism be expanded beyond the limits of our own species to animals with the capacity to feel and suffer, just as we have extended the label of brotherhood steadily until most people now feel comfortable with an all-inclusive phrase, the family of man. Christopher D. Stone, in *Should Trees Have Standing?*, has examined the legal implications of this enlarged generosity. He points out that until recently women, children, aliens, and members of minority groups had few or no legal rights in many societies. Although the policy was once accepted casually and thought congenial to the prevailing ethic, it now seems hopelessly barbaric. Stone asks, why should we not extend similar protection to other species and to the environment as a whole? People still come first—humanism has not been abandoned—but the rights of the owners should not be the exclusive yardstick of justice. If procedures and precedents existed to permit legal action to be taken on behalf of certain agreed upon parts of the environment, the argument continues, humanity as a whole would benefit. I am not sure I agree with this concept, but at the very least it deserves more serious debate than it has received. Human beings are a contractual species. The working principles of ownership and privilege are arrived at by long-term mutual consent, and legal theorists are a long way from having explored their ultimate limits.

If nobility is defined as reasoned generosity beyond expedience, animal liberation would be the ultimate ennobling act. Yet to force the argument entirely within the flat framework of kinship and legal rights is to trivialize the case favoring conservation, to justify one set of ethical beliefs (conservation, animal rights) on the basis of another (kinship, human rights). It is also very risky. Human beings, for all their professed righteousness and brotherhood, easily discriminate against strangers and are content to kill them during wars declared for relatively frivolous causes. How much easier it is to find an excuse to exterminate another species. A stiffer dose of biological realism appears to be in order. We need to apply the first law of human altruism, ably put by Garrett Hardin: never ask people to do anything they consider contrary to their own best interests. The only way to make a conservation ethic work is to ground it in ultimately selfish reasoning—but the premises must be of a new and more potent kind.

An essential component of this formula is the principle

that people will conserve land and species fiercely if they foresee a material gain for themselves, their kin, and their tribe. By this economic measure alone the diversity of species is one of the earth's most important resources. It is also the least utilized. We have come to depend completely on less than 1 percent of living species for our existence, with the remainder waiting untested and fallow. In the course of history, according to estimates recently made by Norman Myers, people have utilized about 7,000 kinds of plants for food, with emphasis on wheat, rye, maize, and about a dozen other highly domesticated species. Yet at least 75,000 exist that are edible, and many of these have traits superior to those of the crop plants in use. The strongest of all arguments from surface ethics is a logical conclusion about this unrealized potential: the more the living world is explored and utilized, the greater will be the efficiency and reliability of the particular species chosen for economic use. Among the potential star species are the following:

- The winged bean (*Psophocarpus tetragonolobus*) of New Guinea has been called a one-species supermarket. It contains more protein than cassava and potato and possesses an overall nutritional value equivalent to that of soybean. It is among the most rapidly growing of all plants, reaching a height of fifteen feet within a few weeks. The entire plant can be eaten, tubers, seeds, leaves, flowers, stems, and all, in both the raw state and when ground into flour. A coffee-like beverage can be made from the liquified extract. The species has already been used to improve the diet in fifty tropical countries, and a special institute has been set up in Sri Lanka to study and promote it more thoroughly.
- The wax gourd (*Benincasa hispida*) of tropical Asia grows an inch every three hours over the course of four days, permitting multiple crops to be raised each year. The fruit attains a size of up to one by six feet and a weight of eighty pounds. Its crisp white flesh can be eaten at any stage, as a cooked vegetable, base for soup, or dessert when mixed with syrup.
- The Babassu palm (*Orbignya martiana*) is a wild tree of the Amazon rain forest known locally as the "vegetable cow." The individual fruits, which resemble small coconuts, occur in bunches of up to 600 with a collective weight of 200 pounds. A colorless oil makes up 60 to 70 percent of the kernel mass and can be used for margarine, shortening, fatty acids, toilet soap, and detergents. A stand of 500 trees on one hectare (2.5 acres) can produce 125 barrels of oil per year. After the oil has been extracted, the remaining seed-cake, which is about one-fourth protein, serves as an excellent animal fodder.

Even with limited programs of research, biologists have compiled an impressive list of such candidate organisms in the technical literature. The vast majority of wild plants and animals are not known well enough (almost certainly many have not even been discovered) even to guess at those with the greatest economic potential. Nor is it possible to imagine all the uses to which each species can be put.

*The California condor, *Gymnogyps californianus*, is the largest bird in North America. With only about fifty individuals surviving, it also is one of the rarest of animals and a prime subject for ethical considerations.*

ERWIN AND PEGGY BAUER



Consider the case of the natural food sweeteners. Several species of plants have been identified whose chemical products can replace conventional sugar with negligible calories and no known side effects. The katemfe (*Thaumatococcus danielli*) of the West African forests contains two proteins that are 1,600 times sweeter than sucrose and are now widely marketed in Great Britain and Japan. It is outstripped by the well-named serendipity berry (*Dioscoreophyllum cumminsii*), another West African native whose fruit produces a substance 3,000 times sweeter than sucrose.

Natural products have been called the sleeping giants of the pharmaceutical industry. One in every ten plant species contains compounds with some anticancer activity. Among the leading successes from the screening conducted thus far is the rosy periwinkle, a native of the West Indies. It is the very paradigm of a previously minor species, with pretty five-petaled blossoms but otherwise rather ordinary in appearance, a roadside casual, the kind of inconspicuous flowering plant that might otherwise have been unknowingly consigned to extinction by the growth of sugarcane plantations and parking lots. But it also happens to produce two alkaloids, vincristine and vinblastine, that achieve 80 percent remission from Hodgkins' disease, a cancer of the lymphatic system, as well as 99 percent remission from acute lymphocytic leukemia. Annual sales of the two drugs reached \$100 million in 1980.

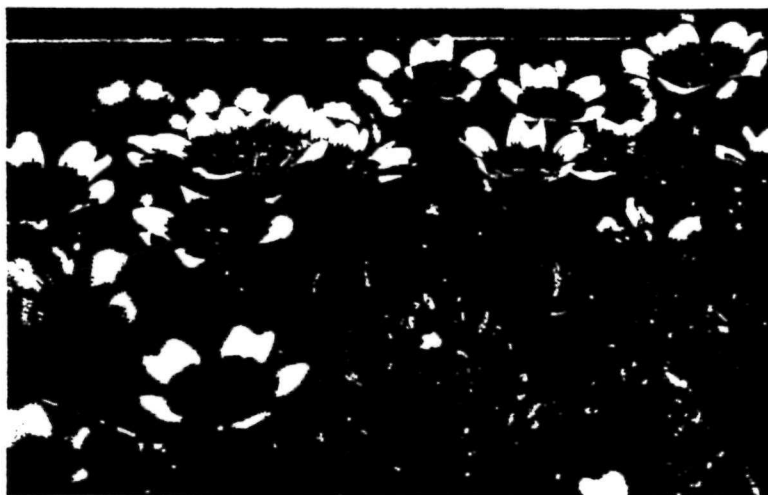
A second wild species responsible for a medical breakthrough is the Indian serpentine root (*Rauwolfia serpentina*). It produces reserpine, a principal source of tranquilizer used to relieve schizophrenia as well as hypertension, a generalized condition predisposing patients toward stroke, heart malfunction, and kidney failure.

The natural products of plants and animals are a select group in a literal sense. They represent the defense mechanisms and growth regulators produced by evolution during uncounted generations, in which only the organisms with the most potent chemicals survived to the present time. Placebos and cheap substitutes were eliminated at an early stage. Nature has done much of our work for us, making it far more efficient for the medical researcher to experiment with extracts of living tissue than to pull chemicals at random off the laboratory shelf. Very few pharmaceuticals have been invented solely from a knowledge of the principles of chemistry and medicine. Most have their origin in the study of wild species and were discovered by the rapid screening of large numbers of natural products.

Natural products also have been utilized in achieving many industrial and agricultural technological advances. Among the most important have been the development of phytroleum, new plant fuels to replace petroleum; waxes and oils produced from indefinitely renewing sources at more economical rates than previously thought possible; novel kinds of fibers for paper manufacture; fast-growing siliceous plants, such as bamboo and elephant grass, for economical dwellings; superior methods of nitrogen fixation and soil reclamation; and "magic bullet" techniques of pest control, by which microorganisms and parasites are set loose to find and attack target species without danger to the remainder of the ecosystem. Even the most conservative extrapolation indicates that many more discoveries will result from just a modest continuation of such research efforts.

Furthermore, the direct harvesting of free-living species is only a beginning. The favored organisms can be bred over about ten to one hundred generations to increase the quality and yield of their desired product. It is possible to create new strains that do well in new climates and the special environments required for mass production. The genetic material comprising them is an additional future

Usable wildness: Below, meadow foam (Limnanthes douglasii), currently under study as a hydrocarbon substitute; top, spotted coral root (Corallorhiza maculata), an Indian sedative, wormer, and remedy for pneumonia.



resource; it can be taken apart gene by gene and distributed to other species. Thomas Eisner, one of the pioneers of chemical ecology, has used a striking analogy to explain these two levels of utilization of wild organisms. Each of the millions of species can be visualized as a book in a library. No matter where it originates, it can be transferred and put to use elsewhere. No matter how rare in its original state, it can be copied many times over and disseminated to become indefinitely abundant. An orchid down to the last hundred individuals in a remote valley of the Peruvian Andes, which also happens to be the source of a medicinal alkaloid, can be saved, cultured, and converted into an important crop in gardens and greenhouse around the world. But there is much more to the species than the alkaloid or some other useful material that happens to package. It is not really a conventional book; it is more like a looseleaf notebook in which the genes are the equivalent of detachable pages. With new techniques of genetic engineering, biologists will soon be able to lift out desirable genes from one species or strain and transfer them to another. A valuable food plant, for example, can be given DNA from wild species conferring biochemical resistance to its most destructive disease. It can be altered by parallel procedures to grow in desert soil or through longer seasons.

A notable case in point is the primitive form of maize *Zea diploperennis*, recently discovered in a mountain forest of southwestern Mexico. It survives only in three small areas totaling a mere ten acres (at any time a bulldozer might easily have extinguished the entire species within hours). *Zea diploperennis* possesses genes for perennial growth, making it unique among all other known varieties of corn. It is thus the potential source of a hereditary trait that could reduce growing time and labor costs, making cultivation more feasible in ecologically marginal areas.



More usable wildness: Left, Indian pipe (*Monotropa uniflora*), used by the Indians for convulsions, epilepsy, and eye ailments; below, birthroot (*Trillium ovatum*), a specific to ease childbirth.

BOTH PAGES, SAXON HOLT



Finally, beyond such practical concerns and far more difficult to put into words, is what biological diversity means to the human spirit. This is what can be called the deep ethic as opposed to the surface ethic of conservation. It is ultimately more convincing and durable and takes approximately the following form. We are human in good part because of the particular way we affiliate with organisms. They are the matrix in which the human mind originated and is permanently rooted, and they offer the virtually endless challenge and freedom innately sought. The scientist is perhaps for the moment more aware than most of the opportunities for discovery and the unending sense of wonder that the living world offers—bear in mind the 1,000 miles of mostly new information in each handful of soil. To the extent that each person can feel as a naturalist, the old excitement of the untrammelled world will be regained. I offer this then as a formula of reenchantment to reinforce poetry and myth: mysterious and little known organisms still live within reach of where you sit. Splendor awaits in minute proportions.

The counterargument to a conservation ethic of any kind is that people come first. After their problems have been solved we can enjoy the natural environment as a luxury. If that is indeed the answer, the wrong question was asked. The question of importance concerns purpose. Solving practical problems is the means, not the purpose. Let us assume that human genius has the power to thread the needles of technology and politics. Let us imagine that we can avert nuclear war, feed a stabilized population, and generate a permanent supply of energy—what then? The answer is the same all around the world: individuals will strive toward personal fulfillment and at least realize their potential. But what is fulfillment, and for what purpose did human potential evolve?

The truth is that we never conquered the world, we never understood it; we only thought we had taken control. We do not even know why we respond in a certain way to other organisms and need them in diverse ways so deeply. The prevailing myths concerning our predatory actions toward each other and the environment are obsolete, unreliable, and destructive. The more the mirror is fathomed in its own right, as an organ of survival, the greater will be the reverence for life for purely rational reasons.

Science and natural philosophy have brought into clear relief the following paradox of human existence. The drive toward perpetual expansion—or if you prefer, personal freedom—is basic to the human spirit. But to sustain it we need the most delicate, knowing stewardship of the living world that can be devised. Expansion and stewardship may appear at first to be conflicting goals, but they are not. The depth of the conservation ethic will be measured by the extent to which each of the two approaches to nature is used to reshape and reinforce the other. The paradox can be resolved by changing its premises into forms more suited to ultimate survival, by which I mean protection of the human spirit.

EDWARD O. WILSON, Baird Professor of Science at Harvard and curator of entomology at the university's Museum of Comparative Zoology, was one of the first scientists to perceive a relationship between population biology and the social structure of all organisms, including human beings. He is the author or co-author of numerous books, including *Sociobiology: The New Synthesis* (1975) and *On Human Nature*, which won the 1979 Pulitzer Prize for general non-fiction. His article is based upon part of a forthcoming book, *Biophilia: The Human Bond to Other Species*, to be issued by the Harvard University Press this fall.

ECOLOGICAL PRINCIPLES - "LAWS OF NATURE"

There are many principles of ecology. As a way to generate thinking about how a few of them apply, please complete the following brief exercise: Match the ecological principle in the left column with the most applicable example in the right column.

- | | |
|---|---|
| 1. ____ Nature strives to maintain balances. | a. At Carlsbad Caverns (NM) and Guadalupe (TX) National Parks, the birth rate of Mountain Lions, previously held in check by pressure of their own numbers, has increased significantly. This is caused by the killing of the young lions by ranchers adjacent to the park. |
| 2. ____ A wide range of tolerance can result in species that are widespread geographically. | b. Overgrazing by cattle at Big Bend totally destroyed the grass over vast areas. Historically, the grass had burned every few years stopping the encroachment of bushes. Without the grass to support fire, creosote bushes have become established to the exclusion of other plants. Creosote bushes poison the soil to protect their source of water from other plants. Therefore, the grass cannot become reestablished and fire cannot control the bushes. |
| 3. ____ Whenever natural processes are changed, nature will respond, sometimes with new alternatives. | c. In the eastern United States, a honeysuckle from Japan and an exotic legume called Kudzu were introduced. They thrive on thin soils and survive cold weather. Now, these fast growing vines have completely covered and replaced thousands of acres of native plants and the animals who previously lived there. |
| 4. ____ The stability of a system increases with the diversity of living things. | d. Where Parks were established on barrier islands, some of the first developments and support facilities located next to the ocean have been washed away. |
| 5. ____ Nature will win in the end. | e. Food for arctic foxes on northern ice floes consists of polar bear excrement and scraps of seal remains left by the bear. If the bear disappears, so do the foxes. |

RESEARCH AND MONITORING

Video Tape Learning Points:

Natural resources management has become the most critical aspect of park management today as complex environmental problems increase and threaten the integrity of park resources.

To achieve the goal of resource protection now and in the distant future, decisions must be based on two things:

1. a thorough understanding of the present condition of park resources...
2. and a knowledge of the history and extent of environmental problems.

Research and Monitoring provide this information.

Research

The most basic and perhaps most vital research is designed to describe the natural resources in a park. The product of this kind of research is Baseline Information.

Baseline Information is simply an inventory of the natural resources in a park, and their condition.

Research can also be designed to solve specific problems such as:
protection of endangered species
control or eradication of non-native species
re-introduction of native species into areas where they have disappeared.

Monitoring

Monitoring focuses on the condition of a natural resource over time. It usually consists of repeated and regularly scheduled sampling of resource condition.

This may include simple field observations, photographic documentation, or sophisticated sampling equipment such as a weather station.

Long-term monitoring is very effective in detecting pollution of air and water resources.

Monitoring programs are often the best way to determine the effect of resource management activities in a park.

Decisions and management actions must be based on sound research and strategic monitoring to ensure perpetuation of the natural resources throughout the National Park System.

LAWS AND POLICIES OF MAN IN NATURAL RESOURCES MANAGEMENT

LAWS

1. The wilderness Act of 1964 allowed the Congress to legislatively preserve certain roadless areas as Wilderness as part of a National Wilderness Preservation System. The following statements are true or false with respect implementation of the Wilderness Act by the National Park Service.

T ☐ F ☐ Motorized equipment is specifically prohibited in NPS Wilderness.

T ☐ F ☐ The Wilderness Act has had a significant impact on the way that the National Park Service manages backcountry.

2. The Endangered Species Act of 1973 provides for the conservation of threatened and endangered species of fish, wildlife, and plants. The following statements are true or false with respect to implementation of the Endangered Species Act by the NPS.

T ☐ F ☐ The U.S. Fish & Wildlife Service, not the NPS, is the lead agency in matters pertaining to threatened and endangered species.

T ☐ F ☐ The main role that the NPS plays in carrying out the intent of this Act is preservation of Critical Habitat and implementation of "Recovery Plan."

3. Under what specific authority may a Superintendent close or restrict the use of a portion of a Park for the purpose of protecting natural resources. (check the correct answer)

☐ There is no authority for the Superintendent to do these things.

☐ Title 36, Code of Federal Regulations.

☐ Legislation establishing the Park Area.

☐ National Environmental Policy Act.

4. Under what authority is hunting or trapping permitted in National Park Service areas. (check the correct answer)

☐ The Director of the National Park Service may authorize hunting or trapping in Park areas.

☐ The Secretary of the Interior may authorize hunting/trapping.

☐ Only the Congress may provide for hunting or trapping in the laws establishing particular NPS units.

POLICY

1. **Why do you believe** that National Park Service policies permit fishing, but **not** hunting, almost everywhere in the Park System?

2. With respect to fisheries management policy, the following statements are either true or false:

T ____ F ____ In natural zones, long established fish stocking programs in once barren lakes and streams may continue at the discretion of the Superintendent.

T ____ F ____ Where lakes are caused by reservoirs, both exotic and native fish may be introduced, under prescribed circumstances, for improved visitor recreation.

3. Other than hunting and fishing, under what circumstances can animals be killed and/or removed from a park? (list as many as you can identify)

4. In roadless areas of large "natural" parks, allowing stands of pine trees to be killed by insect larvae is consistent with NPS Policy.

T ____ F ____

5. Trees and other natural features in historic zones shall be managed to reflect the scene which prevailed during the historic period for which the area was established.

T ____ F ____

6. Integrated Pest Management (IPM) is: (check correct answers)

____ Application of chemical poisons whenever park resources are threatened by mice, cockroaches, poison ivy, or other pests.

____ A method of making decisions about managing pests in the context of the "total environment."

____ A determination, sometimes, to live with a certain level of population numbers of a pest species.

Natural Resource Management

THE NATIONAL PARK SERVICE WILL MANAGE THE NATURAL RESOURCES OF THE NATIONAL PARK SYSTEM TO MAINTAIN AND PERPETUATE THEIR INHERENT INTEGRITY.

National Park Service planning provides for zoning of all park lands in one or all of four land classifications: natural, historic, park development and special use. Each zone in turn may have various subzones. Use and resource management within these zones and subzones are guided by the management policies and carried out through the planning process. Policies valid for any particular zone or subzone shall be the same for any unit of the System except where legal requirements or valid existing rights require exceptions.

Management of park lands possessing significant natural features and values is concerned with ecological processes and impact of people upon these processes and resources. The concept of perpetuation of a total natural environment or ecosystem, as compared with the protection of individual features or species, is a distinguishing aspect of the Service's management of natural lands.

Natural resources--vegetation, animal life, and water and geological features--occur in most areas of the System. The vegetation may be native plants surviving naturally in an isolated section of a large park. It may also be a formal garden laid out and cared for based upon the historic criteria of the period represented. The maintenance of the historic scene and of the integrity of cultural resources is a primary objective in historic zones.

Park development zones are managed and maintained for intensive visitor use. It is understood that roads, walks, buildings, and other visitor and management facilities may occupy much of the area, and that the natural aspect of the land will accordingly be altered. Historic features will be generally absent in park development zones. Management of the park development zone will aim at maintaining a natural environment if possible, given the use of the zone. Such management may be accomplished through the manipulation of the natural environment or by conformance with the approved historical or cultural theme in historical parks. Any manipulation will be the minimum necessary to achieve the planned use. For example, native vegetation should not be extensively replaced by exotic species for solely aesthetic reasons.

Legislation establishing some parks may permit various resource uses, such as grazing, mining and hunting, which are generally not allowed in the National Park System. In some parks, legislation and policies may also provide considerable latitude for active

management of certain resources. Even in such areas, resource management must seek to avoid unnecessary alteration of the natural scene or interference with natural processes.

In all parks it is necessary for the Service to consciously plan for and carry out the management for the priceless heritage entrusted to its care in the manner best designed to perpetuate that heritage now and in the future. Historic scenes may change due to natural processes. Certain ecological processes altered by human activities may need to be abetted to maintain the closest approximation of the natural scene where a truly natural system is no longer attainable. Prescribed burning in the Everglades sawgrass is an example. The effects of use on the natural resources of all areas must be monitored in order to take appropriate action to assure resource perpetuation.

The dynamic nature of plant and animal population, and human influences upon them requires that they be monitored to detect any significant changes. Action will be taken in the case of changes based upon the type and extent of change and the appropriate management policy.

Natural resources specialists will work closely with historians, visitor use specialists, planners and managers to assure that resource management is consistent with each park's purpose and objectives and Service policy.

(See Management Zoning II-3 .)

SCIENCE PROGRAM

Natural and social science information is necessary for management of the National Park System. The National Park Service will, therefore, conduct a program of natural and social science, to support management in carrying out the mission of the Service and provide accurate scientific data upon which all aspects of planning, development, and management of the units of the System may be based.

The Service also may permit the use of parks by qualified investigators for scientific studies when such use shall be consistent with Service policies and contribute to the attainment of park objectives.

(See Information Base II-1, Research Involving Cultural Resources V-6 , Research and Collection Permits VII-20.)

NATURAL RESOURCES MANAGEMENT PLAN

This plan defines the course of action, based on Service policy and law, for the continuous protection, management, and maintenance to perpetuate the resources, to achieve park purpose and objectives, and to appropriately regulate the effect of park use on these resources.

The plan defines the operating program related to all the natural resources and the science program necessary to address crucial aspects or refinements of those operations. In the absence of adequate knowledge, operational programs will be aimed at maintaining the status quo and avoidance of long term or possibly irreversible impacts until priority research can provide necessary information for management changes.

(See The General Management Plan II- 2 , The Historic Scene V-24 , Wilderness Management VI- 6 , Backcountry Use VII- 10 , Regulation of Special Uses VII- 14)

RESOURCE UTILIZATION

As a general policy, the Service does not allow consumptive utilization of renewable or non-renewable park resources. However, the diversity of parks within the System, the occurrence of rights and privileges relating to resource uses continuing from prior to the establishment of certain parks, specific provisions of legislation, and management needs require exceptions and modifications for the management of the System. Where consumptive uses are permitted by law, and where it can be demonstrated that they are detrimental to the purpose of a park, the Service will recommend their elimination, limitation, curtailment, or modification through the legislative process.

In units of the System where specified by law, the Secretary of the Interior may utilize such statutory authority otherwise available to him or her for the conservation and management of natural resources where it furthers, is compatible with, or is not detrimental to the area's purpose.

(See Research and Collecting Permits VII-20 , Collecting Without Permit VII- 21)

DISPOSAL OF TREES AND OTHER NATURAL RESOURCES

Natural resource products accumulated as the result of approved development, vista clearing, and other resource management activities must be salvaged or disposed of in accordance with Service instructions and applicable laws or procedures. Residue resulting from

natural phenomena such as storms and floods will be recycled through the ecosystem, if feasible, but when it poses a threat to human safety or resources, it will be handled in accordance with the same procedures described above.

(See *Landscape and Vegetative Manipulation IV-19*.)

FIREWOOD

Aesthetically pleasing and energy conserving wood fires may be allowed in designated sites. Foraging for firewood may be prohibited in all or part of parks where such activity is adversely impacting the natural or historic scene. Wood salvaged by the Service as a result of conditions described in the preceding section may be supplied for campfires at the discretion of the Superintendent.

Concessioners may sell wood for campfires in park areas if campfire use is consistent with park regulations. Such wood must be obtained from outside the park or purchased from the Service when available under conditions described in the preceding section, "Disposal of Trees and Other Natural Resources."

AGRICULTURAL USES

Natural Zones - Agricultural uses are not permitted in natural zones on parks.

Historic Zones - In historic zones, agricultural activities, including demonstration farms, are permitted where they conform to those that occurred during the historic period and where they do not detract from the principal interpretive purposes.

Agricultural uses that do not conform to those in practice during the historic period are permitted where they contribute to the maintenance of a historic scene, are permitted by law, or are required pursuant to acquisition agreements or similar documents.

Agricultural Subzone - Agricultural practices may be permitted to achieve desirable land uses, in accordance with the area's theme and objectives. Leases or special permits may be issued for the management by others of such agricultural and wildlife enhancement land.

Employee and Community Gardens - Service and concessioner employees living in the parks may cultivate gardens in park development zones and historic zones for personal use, under terms set by the Superintendent, where such use does not deplete or pollute available water supplies, impinge on the visitor's enjoyment of the historic or natural scene, or adversely affect important park resources. In metropolitan parks such as National Capital Parks, community gardens

for recreational gardening may be designated when it has been determined that no significant historic or natural resources are adversely affected, and where such use does not pollute or deplete available water supplies. Pesticide use will be in accordance with established Service regulations and guidelines.

(See Pesticide Use IV-13.)

GRAZING

Commercial grazing is not permitted in any park where such use is detrimental to the primary purpose for which it was established. Grazing on park land is permitted where authorized by law or permitted for a term of years as a condition of land acquisition.

Grazing and raising of livestock is also permitted in historic zones where desirable to perpetuate and interpret the historic scene.

(See Special Use Zone II-4 .)

Control and Regulation of Commercial Grazing - Where the Service has direct control over regulation of grazing, it will require that livestock numbers or trail stock use be kept at a level, and distributed spatially and seasonally, to keep them within the carrying capacity of the area being grazed, and to assure that the needs of wildlife in the same area will be met. Where conduct of grazing occurs through others, such as the Bureau of Land Management, the Service will consult and cooperate to achieve the same goal.

Grazing of Trail Stock - Trail stock (horses, mules, and burros) used by the Service, concessioners, or private parties may graze in natural zones of the parks only incidental to passage through these areas. Such grazing may be curtailed in these areas wherever necessary to restore full use by native wildlife and natural fire regimens. When conditions warrant, Superintendents may publish regulations closing portions of a park to stock or establishing the times and places within natural zones when food for trail stock must be carried by the trail party. Where Service and concessioner trail stock must be quartered in parks, they must be limited to designated areas away from significant park features.

(See Grazing and Stock Driveways VI-3 .)

Commercial Grazing Fees - Fees will be charged on an annual basis and will conform to fees set by the Bureau of Land Management, the Forest Service or private land owners, whichever applies to the area involved.

Elimination of Grazing - Where grazing is permitted and its continuation is not in the best interest of public use or maintenance of the park ecosystem, it will be eliminated, wherever possible, through orderly and cooperative procedures with the individuals concerned.

MINERAL EXPLORATION, LEASING, AND MINING

Mineral exploration, leasing, and mining are not permitted except where expressly authorized by law, except that the Secretary of the Interior has authority for the utilization of resources in certain units of the National Park System. Such utilization is authorized when it will promote, or is compatible with and does not significantly impair, public recreation and the conservation of scenic, scientific, historic, or other values contributing to public enjoyment. Administrative authorization shall be contingent upon compliance with the Procedures for the Protection of Historic and Cultural Properties promulgated by the Advisory Council on Historic Preservation. The National Park Service will strive to control mineral leasing, and eliminate mining activities that are inimical to the purpose of any unit of the National Park System.

(See Special Use Zone II-4 , Wilderness--Mining and Prospecting VI-4 .)

Reference: Regulation of Park Mining Act, September 28, 1976,
P.L. 94-429.

MANAGEMENT OF ANIMAL POPULATIONS

The Service will perpetuate the native animal life of the parks for their essential role in the natural ecosystems. Such management, conformable with general and specific provisions of law and consistent with the following provisions, will strive to maintain the natural abundance, behavior, diversity, and ecological integrity of native animals in natural portions of parks as part of the park ecosystem.

Native species are those that occur, or occurred due to natural processes on those lands designated as the park. These do not include species that have moved into those areas, directly or indirectly as the result of human activities.

Native animal life in the National Park System shall be given protection against harvest, removal, destruction, harassment, or harm through human action, except where:

- hunting and trapping are permitted by law;
- fishing is permitted by law for either sport or commercial use or is not specifically prohibited;
- control of specific populations of wildlife is required for the maintenance of a healthy park ecosystem; or
- removal or control of animals is necessary for human safety and health.

Natural processes shall be relied upon to regulate populations of native species to the greatest extent possible. Unnatural concentrations of native species, caused by human activities, may be regulated if those activities causing the concentrations cannot be controlled. Non-native species shall not be allowed to displace native species if this displacement can be prevented by management. The need for, and results of, regulating animal populations, either native or non-native, shall be documented and evaluated by research studies.

(See Wildlife Observation VII- 7 .)

HUNTING

Hunting, trapping, or other methods of harvest of native wildlife, is not permitted by the public in natural and historic zones, except where specifically permitted by law. Where specifically authorized by Congress, public hunting shall be in accordance with applicable State and Federal laws and regulations. However, the Service may designate zones where, and establish periods when, no hunting shall be permitted for reasons of public safety, administration, or other public use and enjoyment of the area. Under the above provision, the Service, in consultation with States, may ban hunting in part or all of a park for any or all legally huntable game or non-game species for reasons of their:

- being officially designated as endangered, threatened, or locally of rare or unusual occurrence in the park;
- occurring in numbers below the natural capacity of their range; or
- being of greater overall value for wildlife viewing and interpretation.

Regulations prescribing such restrictions shall be issued after consultation with the States.

FISHING

Fishing has been traditionally permitted in the National Park System since the establishment of Yellowstone. The Service will continue this practice, but, in so doing, it affirms that:

- Waters may be closed to fishing to protect rare, threatened, or endangered plant and animal species in the waters on in adjacent habitat.
- Portions of park waters may be closed to fishing when the fish life and other aquatic life has greater value to greater numbers of visitors for the appreciation of plant and animal life, for scientific study, interpretation, or environmental education.
- Fishing may be prohibited in certain waters and at certain times when necessary to protect spawning grounds of endemic fish species or to maintain natural distributions of densities of native wildlife species that use fish for food.
- Fishing may be permitted in historic zones when it does not intrude adversely on the historic scene or harm cultural resources.

Where fishing is permitted, such fishing shall be carried out in accordance with applicable State and Federal laws and regulations. Park regulations may be different for native and non-native species and may be modified for specified waters. Commercial fishing is permitted only where authorized by law.

Natural Zones - Fisheries management shall be:

- specifically aimed towards preservation or restoration of the full spectrum of native species, including fish; and
- regulated for native species so that mortality is compensated by natural reproduction.

No artificial stocking of exotic fish species will occur; artificial stocking of fish may be employed only to reestablish native species. Areas that are added to the National Park System that have had an artificial stocking program shall phase it out. Waters naturally barren of fish will not be stocked with either native or exotic fish species but will be allowed to remain in, or revert to, their natural state.

Special Use Zones - Reservoirs, occurring in a number of areas, represent altered natural environments which may reduce populations of some native species of fish and encourage others. New ecological environments and niches are created which may be most successfully filled by exotic fish species; however, native species will be given precedence over exotic species wherever they are adaptable to the altered environment. Rivers and streams may be stocked with exotic species of fish when it has been determined that exotic species are already present and established and where scientific data indicate the introduction of exotics would not seriously diminish native species populations. Accordingly, the Service, in cooperation with State fish and game officials, may work out programs of fish stocking of reservoirs and other waters for purposes of recreational fishing, using either exotic or native species, or both. Active fishery management programs are encouraged in such waters.

WILDLIFE AND FISH MANAGEMENT IN SPECIFIED AREAS

In areas set aside with legal requirements for wildlife and fish management, the Service will still perpetuate native animal life and protect the integrity of natural ecosystems. Management will be directed towards maintaining populations of fish and wildlife for aesthetic, ecological, recreational, educational or scientific value. In those areas where recreational hunting, trapping, and fishing programs are authorized by law and consistent with park objectives, management programs may be directed toward the maintenance and enhancement of habitat for game animals (including fish, amphibians, mammals, birds, mollusks, and crustaceans). The management of fish and wildlife in these areas must be a cooperative endeavor with the States. These cooperative endeavors will be effected through a Memorandum of Understanding with the respective State.

REGULATION OF WILDLIFE POPULATIONS

Regulation of native animal populations in natural zones shall be permitted to occur by natural means to the greatest extent possible. In parks where hunting is not authorized by law, public hunting on land outside of the park is recognized as a means of controlling wildlife populations that move in and out of park boundaries. Cooperative studies and management plans with States and other Federal agencies will be initiated or continued to facilitate desirable public hunting outside of park boundaries, especially through extended or special seasons established by the States.

Other control measures to be used as necessary may include (1) live trapping in the areas for transplanting elsewhere; (2) providing research specimens for National Park Service and cooperating

scientists; and (3) direct reduction by Service personnel. It is recognized that it may be necessary, on occasion, to carry on various phases of this program simultaneously. The Service will adjust the use of these control measures to meet varying weather and other relevant conditions, giving highest priority to the opportunities for public hunting outside the parks and live trapping within parks for transplanting purposes.

The Service will control wildlife populations or individual animals when necessary for visitor safety and health. Where persistent control problems exist, the Service must determine whether or not curtailment or modification of visitor use and other human activities might not be a desirable alternative. Control may include trapping and transplanting or, only when necessary, destruction of offending animals.

DISPOSAL OF SURPLUS WILDLIFE AND CARCASSES

Where the Service removes animals from the parks, consistent with Service policy, the animals or their carcasses shall be disposed of in accordance with applicable agreements, laws, and regulations. Generally, first priority for disposal of ungulates, both live and as carcasses, is with the various Indian tribes in furtherance of their programs.

Cooperation with States - The Service will consult with the appropriate State fish and game departments in carrying out programs of control of populations of fish and wildlife, or research programs involving the taking of such fish and resident wildlife, including the disposition of carcasses. The Service will refer any resultant disagreements to the Secretary of the Interior, who shall provide for a thorough discussion of the problems with representatives of the affected State fish and game department and the Service for the purpose of resolving the disagreement.

REINTRODUCTION OF NATIVE PLANTS AND ANIMALS

The reintroduction of native species into parks is encouraged, provided that:

- adequate habitat exists in the park and on adjacent public lands and waters to support the species;
- the species, based on an effective management plan, does not pose a serious threat to the safety of park visitors or park resources, or to persons or property outside of park boundaries;

- the species being reintroduced most nearly approximates the extirpated subspecies or race;
- the species disappeared, or was substantially diminished, because of human-induced change--either directly or indirectly--to the ecosystem; and
- confinement of the animals by fencing will be permitted only until the animals become thoroughly accustomed to the new area or they have become established sufficiently that threats from predators, poaching, disease, or other factors have been minimized.

Such programs will be carried out in cooperation with other affected parties and agencies.

THREATENED AND ENDANGERED PLANTS AND ANIMALS

The Service will identify all threatened and endangered species within park boundaries and their critical habitat requirements. As necessary, the Service shall control visitor use and access to such habitat, including closure to entry for other than official purposes. Active management programs, where necessary, may be carried out to perpetuate the natural distribution and abundance of threatened or endangered species and the ecosystem on which they depend, in accordance with existing Federal laws.

The Service will cooperate with the Fish and Wildlife Service, which is recognized as the lead agency in matters pertaining to threatened or endangered species, including delineation of critical habitat on parklands.

Plant and animal species considered to be rare or unique to a park shall be identified also and their distribution within the park mapped. Management actions for their protection and perpetuation shall be incorporated into the natural resources management plan.

(See Natural Resources Management Plan IV-3 , Research and Collecting Permits VII-20.)

EXOTIC PLANTS AND ANIMALS

(This policy is still pending; it will be issued at a later date.)

INSECT AND DISEASE CONTROL

Native insects and diseases existing under natural conditions are natural elements of the ecosystem. Accordingly, populations of native insects and the incidence of native diseases will be allowed to function unimpeded except where control is required (1) to prevent the loss of the host or host-dependent species from the ecosystem; (2) to prevent outbreaks of the insect or disease from spreading to forests, trees, other vegetative communities, or animal populations outside the area; (3) to conserve threatened or endangered, or unique plant specimens or communities; (4) to conserve and protect flora and fauna in developed zones; or (5) for reasons of public health and safety.

The basic objective of insect and disease control in historic zones is to preserve, maintain, or restore the historical integrity of the area. A concerted effort will be made to prolong the life of any

historically significant tree, grove, woodland, forest, or other plant community extant at or representative of the time of the event commemorated. The occurrence of normal endemic populations may be typical of historic, pesticide-free times.

Control operations may be initiated (1) to protect the integrity of the historic scene and (2) to prevent outbreaks from spreading to uninfested forests or trees outside the area.

The measure of control in wilderness areas will be the minimum necessary to prevent escape from the wilderness environment.

PESTICIDE USE

Chemical pesticides of any type will be used only where feasible alternatives are not available or acceptable. The Service's use of all pesticides shall be approved by the Director. Application shall be in accordance with applicable laws, Departmental and Service guidelines, and Environmental Protection Agency and Occupational Health and Safety Administration regulations.

(See Water IV-17.)

FIRE MANAGEMENT

Fire is a powerful phenomenon with the potential to drastically alter the vegetative cover of any park.

The presence or absence of natural fires within a given ecosystem is recognized as a potent factor stimulating, retarding or eliminating various components of the ecosystem. Most natural fires are lightning-caused and are recognized as natural phenomena which must be permitted to continue to influence the ecosystem if truly natural systems are to be perpetuated.

The fire management program of all parks must be designed around park objectives. In natural systems this may include the need for some areas to proceed through succession toward climax while others are set back by fire. Natural zones should represent the full spectrum of the parks' dynamic natural vegetative patterns. Sharply defined zones or blocks of vegetation limited to certain species locked in over time are not natural and only rarely justified. In historic zones fires may be controlled or used to perpetuate the historic scene.

(See Wilderness--Fire Management VI- 8.)

MANAGEMENT FIRES

Management fires, including both prescribed natural fires and prescribed burns, are those fires which contribute to the attainment of the management objectives of a park through execution of predetermined prescriptions defined in detail in the Fire Management Plan, a portion of the approved Natural Resources Management Plan.

Prescribed natural fire is the preferred means to achieve the prescriptions in natural zones. This use of natural ignition may be adopted when analysis of past fire occurrence, distribution, control, and influence, indicates that natural vegetative accumulation and composition has not been significantly altered by past management of fire control. It may also be used where the prescription provides for a transition from an altered state back to historic fuel loading.

In ecosystems modified by prolonged exclusion to fire, prescribed burning may be used to restore fuel loading or vegetative composition to natural levels followed by a prescribed natural fire program, or to create narrow fuel breaks along boundaries of a fire management area and thereby reduce the probability of wildfires crossing into or out of that area.

Prescribed burning may be used as a substitute for prescribed natural fire in natural zones only where the latter cannot meet park objectives. This determination will be documented in the Fire Management Plan. In natural zones, the objective for prescribed burning is to simulate, to the fullest extent, the influence of natural fire on the ecosystem. In other zones it may be used to recreate or perpetuate a historic setting or to attain other resources management objectives.

Clearly defined limits will be established in the prescription of all management fires, beyond which limited or complete control action will be undertaken.

Management fires in the park will be suppressed if they threaten:

- human life;
- cultural resources or physical facilities of the park;
- threatened or endangered species;
- to escape from predetermined zones or from the park, except where cooperative agreements provide for certain fires to cross such boundaries; or
- to exceed the prescription.

WILDFIRE PREVENTION AND CONTROL

All fires not classed as management fires are "wildfires" and will be suppressed.

An active fire prevention program will be conducted in all parks and in conjunction with other agencies to protect human life, prevent modification of park ecosystems by human-caused wildfire, and prevent damage to cultural resources or physical facilities.

Human-caused fires will be controlled to prevent damage and to eliminate impact to the park ecosystems.

The fire suppression methods used in the parks should be those causing the least resource damage, commensurate with effective control.

Cooperative agreements will be developed to facilitate reciprocal fire management activities for land within and adjacent to the parks.

WATER RESOURCES

The waters of a park are a primary resource on par with the wildlife, forest, and geological and historic features, and emphasis should be placed on conservation of water to allow for increased visitation without the need for additional water development. Therefore, the park shall make only those water developments which are absolutely necessary for the visiting public and the operation of the park. Conservation and protection of the water resource are of primary concern to management. Park waters, surface or ground, may be withdrawn for consumptive use so long as such withdrawal is necessary for the use and management of the park and does not significantly alter natural processes and ecosystems. A continuous vigilance will be maintained by observing and monitoring upstream diversions and ground water, withdrawals as to their effect on the occurrence, quantity, and quality of water necessary for the continued preservation of the park ecosystem it supports.

Whenever possible, ground water sources should be developed in lieu of, or for replacement of, surface water diversion in parks as being less susceptible for pollution and requiring less maintenance.

All such water shall be adequately treated so that its return to water courses meets or exceeds applicable State and Federal water quality standards. Irrigation in order to maintain exotic ecosystems or plantings shall be avoided, except where such irrigation is part of an approved management program essential to achieve park objectives, and dependable supplies are available. Wherever possible, park developments will secure water from municipalities or regional suppliers outside the park.

Before new water systems or extensions of existing systems are constructed, it must be determined that reasonable economies in the use of existing water systems will not cover anticipated needs. No new waste treatment plant should be constructed nor should existing plants be enlarged because of increased sewage flow until it has been determined that reductions in water use are not possible.

(See *Pollution Control and Abatement IV- 17.*)

WATER RIGHTS

Water necessary for the development, use, and management of the National Park System will be obtained and used in accordance with the "reserved right" principle where applicable. The "reserved right" principle is applicable on lands withdrawn or reserved from the public domain for authorized purposes without ever having been in territorial or State ownership. The right to use of water to accomplish authorized purposes is also reserved. In cases where that principle is applicable, the proper State agency may be notified, as a matter of comity, of current and foreseeable future water requirements in a manner to be developed with each State. Where the principle is not applicable, water rights will be obtained in accordance with State laws.

Comity notifications and water rights filings shall include a disclaimer as to State jurisdiction, i.e., "Nothing herein shall constitute a waiver of any other right which the United States may have to the same water."

All rights to the use of water diverted to or used on Federal lands in areas of the National Park System by the United States, its concessioners, leasees, or permittees shall be perfected in the name of the United States.

Valid existing water rights of concessioners and land-use permittees on Federal lands will be acquired by the United States as funds, legal authority, and overall management objectives permit.

Water rights owned by inholders within parks will be acquired in connection with the acquisition of such private lands when practicable. Conveyance deeds should cite the quantity of water purchased with the property, and appropriate decree and permit numbers. Similarly, private water rights within parks, attached to impoundments where no land is involved, will be acquired as practicable.

Owners of land or interests in land within or adjacent to parks, under the National Park Service General Authorities Act of 1970 (P.L. 91-838, 84 Stat. 825), may be granted, by special-use permit,

the privilege of developing and using water or sources of water owned by the Service only when it is administratively determined that the use of such water facilitates the management programs of the Service. Such permits will not be issued if any other reasonable source of water supply is available. An application docket containing a draft of the special use permit, background material, and recommendations must be sent to Washington for submission to appropriate congressional committees for review and concurrence prior to consummating any binding commitments. Development costs, including cost of access between the private lands to be served and the source of water, shall be borne by the permittee. In all cases, the Service shall retain the right to use water from such a development. If and when such retained rights are exercised by the Service, it shall share in the cost of the water rights development on an equitable basis.

Owner of lands or interests in lands within or adjacent to Congressionally designated recreation areas may be granted, by special-use permit, the privilege of installing, at no cost to the Government, pipelines or other means to transport water across Federal lands administered by the Service when the water rights are either owned by the permittees or another agency of the Government. An appropriate charge for such rights-of-way shall be made.

(See Inholdings IX- 2.)

POLLUTION CONTROL AND ABATEMENT

The Service will adhere to all applicable provisions of Executive Order 11752 for the prevention, control, and abatement of environmental pollution at Federal facilities. The Service will also adhere to all other applicable Federal, State, and local laws regarding avoidance, amelioration, or elimination of environmental pollution, and will cooperate with the Environmental Protection Agency to this end.

WATER

The Service and its agents will, consistent with applicable Federal, State, and local laws and regulations, maintain the quality of all waters:

1. originating within the boundaries of parks through
 - a. provisions of adequate sewage treatment and disposal for all public-use and administrative facilities, including the requirement for self-contained boat sewage storage units;

- b. control of erosion induced by human activities;
 - c. prevention of direct pollution by livestock through elimination of streamside or lakeside corrals or pastures, or direct watering sites on natural waters;
 - d. regulation and control, as necessary, of fuel-burning water craft;
 - e. avoidance of contamination by toxic substance, such as certain pesticides, herbicides, and heavy metals;
 - f. regulation of the intensity of use in certain areas and at certain times when determined as being necessary based on water quality monitoring; and
2. flowing through or bounding on park areas
- a. by applying the methods listed under 1(a), above, for any water use within the park; and
 - b. by entering into cooperative agreements or compacts with other agencies and governing bodies for cooperative measures to avoid water pollution.

Whenever possible, park sewage and water systems will be connected to outside systems.

(See Pesticide Use IV- 13, Water Resources IV- 15.)

AIR

The quality of the air in the parks plays a vital role in both visitor enjoyment and perpetuation of historic or natural resources. Efforts will be made to control, mitigate or eliminate adverse alteration of the air quality of the parks by industrial/mechanical sources.

Management of in-park pollutant sources and of influences on the parks from outside sources will require close coordination with regional air shed authorities and adjacent agencies. Pollution from transportation, heating, and power generation sources need particular attention. The Service will comply with the Clean Air Act Amendments of 1970, as amended (P.L. 91-604, Dec. 31, 1970; P.L. 95-95, Aug. 7, 1977; 42 USC 7401 et.seq.), directives and other pertinent regulations.

(See Fire Management IV- 13, Formal Campgrounds III-8.)

SOLID WASTE

Proper disposal of all solid waste generated in a park area is the responsibility of the area manager, whether such disposal occurs

inside the Federal reservation or outside. All disposal will be in compliance with guidelines promulgated in the Solid Waste Disposal Act, which apply to waste generated by visitors, concessioners, contractors, park staff, and all other park users. In addition, any park area which issues any license or permit for disposal of solid waste on Federal property shall, before issuance of such license or permit, consult with the Environmental Protection Agency to insure compliance with guidelines contained in this Act.

The Service shall promote the use of biodegradable materials and the reuse and recycling of materials to the degree possible. Waste disposal sites outside of the park will be chosen whenever practical, but if this is impossible, in-park sites for disposal by sanitary landfill shall be carefully selected. Incineration as a means of solid waste disposal shall be used only if there is no other feasible alternative and shall be in compliance with applicable laws and regulations.

(See Comfort Stations III-10, Wilderness--Refuse Disposal VI-6, Backcountry Sanitation VII-12.)

NOISE

Activities causing excessive or unnecessary noise in and adjacent to parks will be monitored and action taken to avoid or minimize noise which detracts from the visitor's enjoyment of park values, unduly disturbs the peace of adjacent neighborhoods, or adversely affects park resources. Maximum noise limits tolerated will, at least, be consistent with OSHA regulations and applicable State and local laws and regulations.

(See Design and Construction Considerations III- 5.)

LANDSCAPE AND VEGETATIVE MANIPULATION

Within the four primary management zones that may occur in parks, programs of landscape and vegetative manipulation have differing purposes and are carried out to achieve approved uses.

Examples are Turkey Run Farm in Washington, D.C., and the pastoral area at Point Reyes National Seashore. Management may include but is not limited to:

- encouragement of certain species of plants for aesthetic or wildlife and vegetative management purposes;
- maintenance of certain plant associations for approved livestock or agricultural uses;

- increasing the ability of certain areas to absorb recreational use through vegetative management; and
- retention of provision of open areas, meadows, vistas.

(See Management Zoning II- 3, Disposal of Trees and Other Natural Resources IV- 3, Exotic Plants and Animals IV-11, Fire Management IV- 13, Inventory of Cultural Resources V- 4, Proposal Formulation Affecting Cultural Resources V- 11, Pesticide Use IV-13.)

NATURAL ZONES

Manipulation of terrain and vegetative cover may be carried out to restore natural conditions on lands altered by human activity through, but not restricted to the following:

- removal of man-made features, restoration of natural gradients, and revegetation with native park species on acquired inholdings and sites from which park development is to be removed;
- restoration, to a natural appearance, of areas disturbed by fire control activities; and
- minor or infrequent rehabilitation of limited visitor impacted areas. Regular activities such as vista clearings should be limited to defined Landscape Management Area Subzones.

Conditions caused by natural phenomena such as landslides, earthquakes, floods, and natural fires will be modified as little as possible commensurate with public safety and the reconstruction--if necessary and desirable--of public use facilities in the affected area.

HISTORIC ZONES

Trees, other vegetation, and other natural features in a historic zone shall be managed to reflect the historic scene which prevailed during the historic period.

Every effort shall be made to extend the lives of specimen trees dating from the historic period. An individual tree of historical value posing a safety hazard, and diseased beyond recover, shall be removed and replaced. Provisions should be made, while unique trees or shrubs are healthy, for their eventual replacement by progeny through sprout, seed or cuttings.

(See Exotic Plants and Animals IV-11, Insect and Disease Control IV-12, The Historic Scene V-24.)

SPECIAL USE ZONES

Primary authority over these lands rests with entities other than the National Park Service. The management of the national resources of these zones will be directed (to the maximum extent possible) toward achievement of the defined objectives of the park. Vegetative manipulation may be used to achieve these objectives.

(See Exotic Plants and Animals IV-11.)

PARK DEVELOPMENT ZONES

Management of landscape and vegetation in developed areas shall be commensurate to the greatest extent possible with the purpose of a given park. The landscape and vegetation should be managed to affect the transition between park developments and the terrain, biota, and physical appearance of surrounding management zones commensurate with the requirements and impacts of visitor use.

Rehabilitation and maintenance is expected on areas impacted by visitor use including, if necessary, the redesign, relocation, removal--or the provision--of facilities to avoid or ameliorate adverse visitor impacts on the ecosystem.

(See Construction III- 6 , Design Quality and Control III- 5 , Employee and Community Gardens IV- 4 , Exotic Plants and Animals IV-11.)

WEATHER MODIFICATION

Weather modification projects affecting parks generally are in conflict with the congressional mandate to perpetuate the integrity of the park environment. Therefore, the National Park Service is opposed to modification proposals unless it can be conclusively demonstrated that weather modification will not influence the natural or historic environments of National Park System areas.

(See Hydrometeorologic Devices VI- 6 .)

CAVE MANAGEMENT

The National Park Service will manage caves for the perpetuation of their natural, geological and ecological conditions, and historic associations.

Developments such as artificial entrances, enlargement of natural entrances, pathways, lighting, interpretive devices, ventilation

systems and excavation of elevator shafts are permissible only where necessary for general public use when such development will not significantly alter any conditions perpetuating the natural cave environment or harm historic resources. General public access by tours of suitable duration and interest will be limited to a representative sample of a cave.

No development above or adjacent to caves will be undertaken which would significantly alter natural cave conditions including sub-surface water movements.

Caves, or portions of caves, may be closed to public use or restricted to access by conducted tours when such actions are required for human safety and the protection of cave resources. Caves, or portions of caves, may be managed exclusively for research and access limited to approved research personnel.

SHORELINE PROCESSES

In natural zones, shoreline processes--erosion, deposition, dune formation, inlet formation, etc.--will be allowed to take place naturally, except where control measures, required by law or Service commitment, are necessary to protect life and property in neighboring areas.

In historic zones, control measures, if necessary, will be predicated on thorough studies taking into account the nature and velocity of the shoreline processes, the threat to the cultural resource, the significance of the cultural resources, and alternatives, including costs, for protecting the cultural resource. Such studies must also determine if and how control measures would impair resources and processes in natural zones, in order that management may make an informed decision on the course of action to be followed.

In development zones, management should plan to phase out, systematically relocate, or provide alternative developments to facilities located in hazardous areas that cannot be reasonably protected. New developments will not be placed in areas subject to flood or wave erosion or active shoreline processes unless it can be demonstrated that they are essential to meet the park's purpose, that no alternative locations are available, and that the development will be reasonably assured of surviving during its planned lifespan without the need of shoreline control measures. Before development in such areas is provided, the requirements of Executive Order 11968, "Floodplain Management" must be fulfilled.

Where erosion control is required by law, or where present developments must be protected to achieve park management objectives, the Service will employ the most natural appearing and effective method feasible.

Most shoreline areas of the National Park System are part of larger physiographic systems, and the processes of these larger systems directly affect the management of those NPS areas contained therein. Therefore, the Service shall seek to obtain the assistance of appropriate Federal, State and local agencies in carrying out the management objectives of NPS shoreline areas.

The Service will cooperate with State and other Federal entities to develop strategies for maintaining existing transportation and utility links on barrier islands in the event of storm damage or inlet formation. Where these links are interrupted by inlet formation, the Service will recommend, within the limits of practicality, reestablishment in a manner that allows the unimpeded operation of inlet formation and closures.

Where navigation channels are established in NPS waters, the Service will work with the responsible agency to see that necessary dredging is carefully controlled and that dredged material is disposed of in such a manner as to have the least adverse impact on the aquatic ecosystem and to optimize the value of spoil deposit as wildlife habitat.

(See Cooperation for Preservation I-9 , Cooperative Regional Planning II-5 .)

SELECT LIST OF CONSERVATION LAWS APPLICABLE TO NATURAL RESOURCES
MANAGEMENT, PLANNING, AND ADMINISTRATION OF THE NATIONAL PARK SYSTEM.

By virtue of many legislative acts, the Congress has assigned the National Park Service a unique and dual role. We are mandated to serve people and to manage a wide variety of natural, historic, and prehistoric resources. The laws identified here, with summaries of key provisions, represent authority and guidance for management of our natural resources. Only those laws with significant and/or continuing impact are included here. The entire text of the laws listed, and many not included, may be found in the United States Code.

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FEDERAL LAWS CONCERNING THE NATIONAL PARK SYSTEM

Act of March 1, 1872 - Yellowstone Park Act

By this Act the Congress set aside a certain tract of land near the headwaters of the Yellowstone River as a public park. Generally, the Act signified establishment of a new public policy; namely, that portions of the public lands were to be:

"...reserved and withdrawn from settlement, occupancy or sale under the laws of the United States and dedicated and set apart as a public park or pleasuring ground for the benefit and enjoyment of the people...That..the Secretary of the Interior...shall provide for the preservation, from injury or spoilation, of all timber, mineral deposits, natural curiosities or wonders within said park, and their retention in their natural condition."

ANTIQUITIES ACT

(P.L. 59-209; 16 U.S.C. 431-433)

The Act of June 8, 1906 served the following three general purposes:

1. Authorized the President of the United States, at his discretion, to declare by public proclamation Historic Landmarks, Historic and Pre-historic structures, and other objects of historic or scientific interest that are situated upon lands owned or controlled by the Government of the United States to be National Monuments. This section of the Act further restricted such designations to the "smallest areas compatible with the proper care and management of the objects to be protected."
2. Section 432 of the Act authorized the issuance of permits to examine ruins, excavate archaeological sites, and gather objects of antiquity upon the lands under the respective jurisdictions of the Secretaries of Interior, Agriculture, and Army. This section further required that such examinations, excavations, and gatherings of objects be undertaken only for the benefit of reputable museums, universities, colleges or other recognized scientific institutions.
3. Section 433 prohibited any person from taking, excavating, injuring, or destroying any historic or prehistoric ruin or monument, or any object or antiquity on public lands. This section further identified the maximum penalty for violation of these prohibitions as \$500 or imprisonment for a period of not more than ninety days, or both.

Passage of the Archeological Resources Protection Act (1979) supercedes the Antiquities Act as an alternate Federal tool for prosecution of antiquities violations in N.P.S. areas. Sections 432 and 433 will not be applied when regulations required by ARPA are finalized.

THE NATIONAL PARK SERVICE ORGANIC ACT OF 1916

(16 U.S.C. 1 et seq)

With this Act, Congress established the National Park Service. Congress assigned to this new agency the administration of all the National Parks and most of the National Monuments (did not include those under Departments of Agriculture or War) heretofore established. In this 1916 Act the Congress also established a broad framework of policy for the administration of these areas; namely, that:

"The Service thus established shall promote and regulate the use of the Federal areas known as National Parks, Monuments, and Reservations... by such means and measures as conform to the fundamental purpose of the said Parks, Monuments, and Reservations, which purpose is to conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."

In addition, this Act gave the Secretary of the Interior authority to do certain things:

He was to make such rules and regulations necessary for the use and administration of areas under the National Park Service. He could sell and dispose of timber, under certain conditions and he could destroy animal and plant life which might be detrimental to the use of the park. He could grant leases for concessioners and he could permit the grazing of livestock if not detrimental to the area, except there could be no grazing in Yellowstone National Park.

LACEY ACT

(18 U.S.C. 42-44, Title 50 CFR, P.L. 97-79, most recent amendment)

The Lacey Act was one of our first Federal wildlife laws, passed in 1900 to outlaw interstate traffic in birds and other animals illegally killed in their State of origin. It was aimed at the so-called "pot hunter," those people who killed large amounts of wildlife for sale. It was viewed then, and should be viewed now, as a Federal tool to aid the States in enforcing their own conservation laws. The Lacey Act has been amended several times and its coverage expanded to include wildlife taken in violation of foreign law as well as State law. The Black Bass Act of 1926 was based on the same philosophy as the Lacey Act. It provided Federal sanctions for the illegal interstate transportation of black bass taken, purchased, sold or possessed in violation of State law. The Black Bass Act was subsequently expanded to cover all species of fish, and in 1969 was amended to encompass foreign commerce and fish taken, bought, sold, or possessed in violation of foreign law.

The Lacey Act Amendments of 1981 combine the Lacey and Black Bass Acts into a single comprehensive statute to provide more effective enforcement of State, Federal, Indian tribal, and foreign conservation laws protecting fish, wildlife, and rare plants.

Highlights of the Lacey Act, as amended in 1981

1. Generally, prohibits the import, export, transport, sale, acquisition, or receiving of any fish or wildlife or rare plant taken or possessed in violation of Federal, State, foreign, or Indian tribal laws.
2. Provides both Civil and Criminal Penalties.
 - a. A civil penalty, up to \$10,000, may be assessed when the violator, in the exercise of due care, should have known that the fish, wildlife, or plants were taken, possessed, transported, or sold in violation of any underlying law.
 - b. Criminal penalties (maximum \$20,000 for prescribed felonies; maximum \$10,000 for misdemeanors) are identified. The Act also authorizes forfeiture of all vessels, vehicles, aircraft and other equipment used to aid in all criminal violations of the Lacey Act as amended in 1981 under identified circumstances.

Park Responsibilities

CFR regulations protect wildlife, fish, and all plants that may be taken or possessed in National Park areas. This Act, however, gives much greater discretion to park managers and the United States Attorney to prosecute criminally, or handle civilly, more serious violations involving the taking of wildlife, fish, or rare plants. Discussions between the U.S. Attorney's Office and local Fish & Wildlife Service enforcement agents should occur whenever commercial or other serious degradation of these resources is suspected on park lands.

BALD AND GOLDEN EAGLE PROTECTION ACT

(16 U.S.C. 668-668c P.L. 86-70, as amended)

This statute prohibits taking, possession and trade in bald and golden eagles. It originated by Act of Congress in 1940, with only bald eagles given protection at that time. An amendment in 1962 gave the same protection to golden eagles, largely because bald eagles were mistakenly being killed and of the sudden decline of golden eagles. A third amendment in 1973 provided increased criminal penalties and made second and subsequent offenses felonies. In its present form, the Eagle Act:

1. Provides federal protection for bald and golden eagles.
2. Provides for criminal or civil penalties for violations and a reward to informers. A violation is considered "civil" unless the act was committed knowingly, or with wanton disregard for the consequences of the act.
3. Authorizes cancellation of grazing, leases, licenses, permits or other agreements for violations.
4. Provides for taking, possession and transporting golden eagles for falconry, under certain conditions.

5. Authorizes designated officers (included Commissioned N.P.S. employees) to enforce the Act.
6. Authorizes the Secretary of the Interior to enter into cooperative agreement with State Fish and Game agencies to help enforce the Act.
7. Provides for seizure and forfeiture of all eagles, parts and equipment involved in a violation of the Act.
8. Makes money available for administration and enforcement of the Act, including provisions for payment up to \$2500 to person(s) giving information which leads to a conviction under this Act.
9. The Secretary is authorized to permit the taking of eagles under limited circumstances, such as for scientific or educational purposes and protection of wildlife or ranching interests. Courts have not yet decided how the Act applies to Indians. The language of the statute indicates clear intent by Congress to prohibit all sales of eagles and their parts, even by Indians. Another section, however, deals with the use of eagles by Indians and provides that under particular situations Indians may hunt, possess and transport eagles.

Park Responsibilities

CFR regulations protect eagles along with all wildlife. This Act, however, gives considerable discretion to park management and the U.S. Attorney to exact a more severe penalty for taking or possession of eagles, if circumstances warrant. Discussion between the U.S. Attorney's Office, however, and the area Fish and Wildlife enforcement agents, should occur whenever possible violations of this Act take place in a park area.

THE WILDERNESS ACT OF 1964

(P.L. 88-577, 78 Stat. 890; 16 U.S.C. 1131-1136)

The purpose of the Wilderness Act is to legislatively establish an enduring and unimpaired wilderness resource for public use and enjoyment. It directed the Secretaries of Interior and Agriculture to study all roadless areas of 5,000 or more acres and every roadless island (regardless of size) as to suitability for inclusion in the National Wilderness Preservation System by later special Acts of Congress.

A Wilderness Area is defined as a tract of undeveloped Federal land. of primeval character, and without permanent improvements or human habitation. The forces of nature predominate, and the imprint of human habitation. The forces of nature predominate, and the imprint of human civilization is not readily perceived. The area provides outstanding opportunities for solitude and an unconfined type of recreation.

The Act provides criteria for determining suitability and contains provisions relating to activities that can be undertaken with a Wilderness Area. Areas authorized by Congress for inclusion in the Wilderness Preservation System will continue to be managed by the agency having jurisdiction prior to such designation. The Act further specified that designation of a park area as wilderness shall in no manner lower the standards evolved for the use and preservation of such parks in accordance with the Act to establish a National Park Service, August 25, 1916, and other applicable legislation. As of 1981, 35,331,560 acres in 34 units of the National Park Service have been established as part of the National Wilderness Preservation System. 32,355,000 of this acreage is in Alaska.

Park Responsibility

Comply with National Park Service management policies and directives with respect to wilderness studies, and appropriate human activities before and after the legislative process is completed.

LAND AND WATER CONSERVATION FUND ACT OF 1965

(16 U.S.C. 4601 - 4601-11; P.L. 88-578)

The Land and Water Conservation Fund Act established the Land and Water Conservation (L & WCF) in the U.S. Treasury. The Act is designed to help the states and federal agencies meet needs and demands for outdoor recreation. The money for the L&WCF fund is derived from several sources:

1. Sales of surplus property by the GSA under the Federal Property and Administrative Services Act of 1949;
2. Proceeds from the Federal tax on motorboat fuels;
3. Appropriations from the Treasury;
4. Receipts from offshore leasing under the Outer Continental Shelf Lands Act.

The Act describes how the fund will be dispersed between state and Federal projects, and requires that the state share the cost of federally assisted projects. It requires each state to prepare a "comprehensive statewide outdoor recreation plan," subject to approval by the Secretary of the Interior, to become eligible for L&WCF assistance.

The Act also establishes a second fund in the U.S. Treasury "to be administered in conjunction with, but separate from, the revenues in the Land and Water Conservation Fund" and to be used to support Federal recreational programs and projects. This agency specific fund is supported by each contributing agency's revenues from (1) entrance fees at Federal park and recreation areas, and (2) special recreational use fees "for the use of sites, facilities, equipment, or services furnished at Federal expense." The Act contains specific provisions relating to annual admission permits, single visit fees, overnight occupancy fees, and special recreation permits. Funds from fees in N.P.S. areas are deposited in the U.S. Treasury and are reallocated to the agency as part of the annual appropriation from the Congress.

Park Responsibilities

Regulations promulgated pursuant to this Act are found in Part 18, Title 43, Code of Federal Regulations. Park managers and subordinate staff must comply with these regulations in all fee collecting activities.

Park managers and subordinate staff should develop strategies to explain to visitors and neighbors the ways that the Land and Water Conservation Fund Act works for them.

NATIONAL TRAILS SYSTEM ACT

(16 U.S.C. 1241 et seq 1968. P.L. 90-543)

The National Trails System Act, enacted in 1968, established a national system of recreation and scenic trails. It designated the 2,000-mile-long Appalachian Trail and the 2,350-mile-long Pacific Crest Trail as the first components of the system and defined methods for designation of additional components. It identified components of the National Trails System, and defined them as follows:

National recreation trails - are those that provide a variety of outdoor recreation used in or reasonably accessible to urban areas.

The Secretary of the Interior, or the Secretary of Agriculture where lands administered by him are involved, may establish and designate national recreation trails, with the consent of the Federal agency, State, or political subdivision having jurisdiction over the lands involved, under certain prescribed criteria.

National scenic trails - are extended trails so located as to provide for maximum outdoor recreation potential and for the conservation and enjoyment of the nationally significant scenic, historic, natural, or cultural qualities of the areas through which such trails may pass. National scenic trails shall be authorized and designated only by Act of Congress.

Connecting or side trails - are established to provide additional points of access to national recreation or national scenic trails, or which will provide connections between such trails.

National historic trails - Public Law 95-625, 1978, amended the National Trails System Act to designate one additional National Scenic Trail and create the new category of National Historic Trails. Established in the same manner as scenic trails, historic trails will closely follow original routes of national historic significance.

At the present time, (1/82) five National Scenic Trails have been designated by the Congress, three administered by the National Park Service. These three are the Appalachian Trail, the North Country Trail, and the Ice Age Trail. By provisions in the law the State of Wisconsin is the lead planning agent for the Ice Age Trail. With exception of the Appalachian Trail, the primary responsibilities for the remaining two are restricted to comprehensive planning at this state of development. The Continental Divide Trail and the Pacific Crest Trail are administered by the U.S. Forest Service.

Likewise, five National historic trails have been established by Congress - The Oregon Trail, the Lewis and Clark Trail, the Mormon Pioneer Trail, the Overmountain Victory Trail, and the Iditarod National Historic Trail. All but the latter are administered by the National Park Service, with comprehensive planning the focus at present. The Iditarod Trail is administered by the Bureau of Land Management.

There are over 630 National Recreation Trails, most administered by the U.S. Forest Service.

A number of other trails are presently being considered for designation by Congress.

WILD AND SCENIC RIVERS ACT

(16 U.S.C. 1271-1287; P.L. 90-542)

The 1968 Act established the National Wild and Scenic Rivers System and outlines criteria for including free-flowing streams, or portions thereof, in the system. It initially established eight components of that system and prescribes the methods and standards through which additional rivers, including 27 listed as potential components, may be identified and added to the System. The Act authorizes the Secretary of the Interior and the Secretary of Agriculture to study areas and submit proposals to the President and the Congress for additions to the system. It describes procedures and limitations for control of lands in Federally administered components of the system and for dealing with the disposition of lands and minerals under Federal ownership. It defines distinctions between wild, scenic, and recreational rivers as follows:

Wild river areas - Those rivers or sections of rivers that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted. These represent vestiges of primitive America.

Scenic river areas - Those rivers or sections of rivers that are free of impoundments, with shorelines or watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads.

Recreational river areas - Those rivers or sections of rivers that are readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past.

Hunting and fishing are permitted in components of the system under applicable Federal and State Laws.

Among areas administered within the National Park System under the provisions of this Act are: St. Croix N.S.R., the Upper and Middle Delaware River, the Obed national Scenic River, and 12 Rivers in the National Parks of Alaska.

THE NATIONAL ENVIRONMENTAL POLICY ACT OF 1969

(P.L. 91-190, 31 STAT. 852; 42 U.S.C. 4321-4347)

This Act declares that it is the policy of the federal government to use all practical means, consistent with other essential considerations of national policy, to -- among other things -- improve and coordinate federal plans, functions, programs, and resources to the end that the nation may preserve important historic, cultural, and natural aspects of our heritage. It directs that, to the fullest extent possible, the policies, regulations, and public laws of the United States shall be interpreted and administered in accordance with the Act and that all agencies shall utilize a systematic interdisciplinary approach that will insure the integrated use of the natural and social sciences and the environmental design arts in planning and decision-making which may have an impact on man's environment. It further requires that on all federally-sponsored or licensed projects which significantly affect the environment, the responsible official submit an environmental impact statement which assesses the impact of the proposed action and any unavoidable adverse environmental effects which consistently has been interpreted to include those on archaeological and historic resources), and sets forth the alternatives to the project, the long and short term results, and any irreversible and irretrievable commitment of resources.

The Act also established the Council on Environmental Quality in the Executive Branch to advise and assist the President in carrying out the provision of the Act in reviewing environmental impact statements.

Park Responsibility:

- Assure that documents are prepared assessing in detail the environmental impacts of every proposed action that may significantly affect the quality of the human environment according to the definition and requirements in NPS - 12, NEPA Procedures.
- Determine whether the action is a categorical exclusion requiring no action, or one with potential requiring either a Memorandum to the Files or an Environmental Assessment.
- Following preparation of an Environmental Assessment, if required, and appropriate public involvement according to NPS Procedures, initiate an Environmental Review recommending selection of an environmentally preferable alternative, make a finding as to whether the selected alternative will have a significant impact requiring preparation of an Environmental Statement, and submit the Environmental Review to the Regional Director for review and approval.
- If an Environmental Statement is required, the Superintendent and/or staff consults with or serves on the team preparing the statement.
- Follow-up on environmental documents to assure that the selected action is dealing properly with impacts and that mitigating measures are carried out.
- Provides comments, on request, concerning environmental documents by other agencies from the standpoint of expertise or jurisdiction.

THE COASTAL ZONE MANAGEMENT ACT OF 1972

(16 U.S.C. 51451, P.L. 92-583)

With this Act the Congress determined it to be national policy that the Nation's coastal zone be preserved, protected, developed, and restored or enhanced; and that states be encouraged and assisted in developing and implementing management programs to achieve wise use of the land and water resources of the coastal zone.

The Act authorizes the Secretary of Commerce to make grants to coastal states (including those bordering the Great Lakes) for use in developing a management program for the land and water resources of its coastal zone and for the purpose of assisting any coastal state in completing and implementing a management program. These plans consist of (1) identification of the coastal zone boundaries, (2) determination of permissible land uses within the coastal zone, (3) inventory of areas of particular concern, (4) identification of the means for state control of land use, (5) the priority of uses in the coastal zone, and (6) the organizational structure for implementing the plan. The Secretary is also authorized to approve the state plan and to make annual grants for its administration.

Applicants for Federal licenses or permits (including plans for exploration, development, or production of oil and gas pursuant to a Federal lease on the outer Continental Shelf) are required to certify that their activities are consistent with the management programs of directly affected coastal states. Section 307 (c) of the Act requires Federal agencies conducting projects or activities directly affecting the coastal zone to carry them out, to the greatest possible degree, in a manner consistent with the approved state coastal zone management plan.

Park Responsibility

In preparing plans for development, visitor use management, resources management, etc., for coastal zone parks, park personnel and planners must become familiar with the state coastal zone management plan. The interaction between the state plan and proposed NPS actions is documented in the planning record and made a part of the environmental statement if one is prepared. NPS actions on Federal land should be compatible to the fullest extent practical with state management plans for lands in the coastal zone.

The necessary consultation with responsible state agencies is achieved by following existing NPS guidelines for NEPA compliance.

ENDANGERED SPECIES ACT OF 1973

(P.L. 93-205; 87 Stat. 884; 16 U.S.C. 1531-1543)

This Act provides for the conservation of threatened and endangered species of fish, wildlife, and plants through Federal action and by encouraging state programs. It defines endangered species as those in danger of extinction throughout all or a significant portion of their range. Threatened species are described as those likely to become endangered throughout all or a significant part of their range. The Act prohibits taking, possession, sale, transport, etc., of endangered species; authorizes an expanded program of habitat acquisition; authorizes the establishment of cooperative agreements and grant-in-aid to those states which establish and maintain an active and adequate program for endangered and threatened species; and establishes penalties for violation of the Act or regulations.

Section 7 of the Act requires Federal agencies to consult with the Secretary of the Interior or the Secretary of Commerce on all projects and programs having potential impact on endangered or threatened species. It further requires them to take "such action necessary to insure that actions authorized, funded, or carried out by them do not jeopardize such endangered or threatened species or result in the destruction or modification of habitat...."

Park Responsibility:

- Maintain inventory of endangered or threatened species within the park area, either permanently or seasonally.
- Consider impact of any project or program upon endangered or threatened species.
- Maintain liaison with U.S. Fish and Wildlife Service concerning applicable regulations and changes in subject listings.

CLEAN AIR ACT

(42 U.S.C. 1857 - 1857f; as amended on August 7, 1977, by P.L. 95-95)

The Clean Air Act is one of great complexity with a multitude of purposes. One of the purposes of Title I of the Act is the preservation, protection and enhancement of air quality in National Parks, National Wilderness Areas and other areas of special natural, recreational, scenic or historical value. The 1977 amendment establishes Class I, II, and III areas where the increase of sulphur dioxide and particulate matter is to be restricted. The restrictions are most severe in Class I areas and progressively more lenient in Classes II and III. Mandatory Class I Federal lands include National Parks in excess of 6,000 acres existing as of 8/7/77, international parks, and wilderness areas and National Memorial Parks in excess of 5,000 acres. Such lands may not be redesignated. Federal land managing agencies will review all other areas under their jurisdiction and recommend appropriate areas for redesignation to Class I status. The Act also authorizes states and Indian tribes to redesignate areas. The Federal Land Manager is charged with direct responsibility to protect the air quality and related values, including visibility of Class I lands and to consider, in consultation with the Environmental Protection Agency, whether proposed industrial facilities will have an adverse impact and whether existing industrial sources of air pollution must retrofit to reduce visibility impacts on Class I areas to acceptable levels.

The Act further requires all Federal agencies to comply with Federal, State, interstate, and local requirements towards control and abatement of air pollution.

Park Responsibilities

Keep abreast of State implementation plans (SIP's) to assure that the park facilities and programs are in compliance.

Managers have an "affirmative responsibility" to protect air quality related values of Class I areas. Managers of such areas should identify vulnerable resources and track developments in the surrounding region that might have impact on air quality.

Establish monitoring and/or research programs for determining baseline condition and impairment to air quality related values.

Establish contact with permitted authorities to facilitate early involvement and notification of any proposed major emitting facility. Provide timely response to any permit application submitted for review.

Establish air quality related values - visibility section as part of resource management plan and included in the Statement for Management.

CLEAN WATER ACT

(P.L. 92-500; P.L. 95-217, 33 U.S.C. 1251 et seq.)

The Federal Water Pollution Control Act (P.L. 92-500) as amended by the Clean Water Act of 1977 (P.L. 95-217). 33 U.S.C. 1251 et seq. provides for a complex set of pollution control activities. "The objective of the Act is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters."

The act establishes 6 national goals:

- (1) The discharge of pollutants into navigable waters be eliminated by 1985;
- (2) whenever attainable, water quality will provide for the protection and propagation of fish, shellfish, and wildlife, and provide for recreation on water by July 1, 1983;
- (3) the discharge of toxic pollutants in toxic amounts is prohibited;
- (4) Federal financial assistance is provided to construct publicly owned waste treatment works;
- (5) area-wide waste treatment management planning processes are to be developed and implemented; and
- (6) a major research and demonstration effort will be made to develop required technology to eliminate pollutant discharges.

Park Responsibilities

Section 313 of the Act (33 U.S.C. 1323) and E.O. 12088 establish a Federal compliance responsibility, for all facilities and lands over which the agencies have jurisdiction, and for all activities which do or may result in runoff of water born pollutants. All Federal officers, employees, or agents shall comply with all applicable Federal, state, interstate, and local requirements, administrative authority, and procedures and sanctions respecting the control and abatement of water pollution in the same manner and to the same extent as any non-governmental entity."

Section 301 and 302 of the Act (33 U.S.C. 1311 et seq.) provides for effluent standards and water quality standards and requires direct discharges to conform to both standards, whichever is stricter.

Section 402 of the Act (33 U.S.C. 1342) establishes the permit system which is the enforcement mechanism of the Act. The National Pollution Discharge Elimination System (NPDES) permits are required for all Federal facilities before discharge of any pollutant, and administrative and judicial remedies are provided for non-compliance which may subject Federal facilities to state enforcement actions in state courts.

Section 404 of the Act (33 U.S.C. 1288) established provisions for area-wide planning and waste management and provided for Federal participation on and coordination with this program, as articulated in the M.O.U., dated Nov. 13, 1978 between EPA, U.S.F.W.S., HCRS, and NPS. NPS is called upon to participate in

water quality planning and management; establishment of standards and criteria; and, establishment of water quality monitoring systems.

Section 308 of the Act (33 U.S.C. s) establishes a requirement for monitoring.

Section 104 of the Act encourages the conduct of needed "research, investigations, experiments, training, demonstration, surveys, and studies relating to the causes, effects, extent, prevention, reduction, and elimination of pollution."

Amending the Act of October 2, 1968, An Act to Establish A Redwood National Park

(P.L. 95-250 Title I, S. 101(b) March 27, 1978)

The primary purpose of this Act was to amend 1968 legislation establishing Redwood National Park. Within the Act, however, Congress amended the Act of August 18, 1970, and provided additional guidance with respect to management of the National Park System as follows: "Congress further reaffirms, declares, and directs that the promotion and regulation of the various areas of the National Park System shall be consistent with and founded in the purpose established by the first section of the Act of August 25, 1916, to the common benefit of all the people of the United States. The authorization of activities shall be construed and the protection, management, and administration of activities shall be constructed and the protection, management, and administration of these areas shall be conducted in light of the high public value and integrity of the National Park System and shall not be exercised in derogation of the values and purposes for which these various areas have been established, except as may have been or shall be directly and specifically provided by Congress."

With this additional amendment to the Law the Secretary is to afford the highest standard of protection and care to the natural resources within Redwood National Park AND THE NATIONAL PARK SYSTEM. No decision shall compromise these resource values except as Congress may have specifically provided.

ADMINISTRATION OF THE NATIONAL PARK SERVICE

(P.L. 91-383, 16 U.S.C. Section 1a-1 et seq)

With this Act the Congress recognized that the national park system had grown considerably and now included a great variety of natural, historic and recreation areas in every major region of the United States and its territories. The purpose of this Act was to... "include all such areas in the System and to clarify the authorities applicable to the System."

Many of the provisions and authorities of this Act were substantially amended by the Act of October 7, 1976.

NATIONAL PARK SERVICE AUTHORITIES ACT

(P.L. 94-458; 16 U.S.C. Section 1a et seq)

With this comprehensive legislation the Congress amended or repealed many provisions from previous Acts and provided additional improvement and authorization for the administration of the National Park System. It further clarified authorities applicable to the National Park System and for other purposes.

Often considered mainly for its provisions clarifying law enforcement authority, this Act additionally covered a variety of other significant elements. Several amendments to the Act of August, 1970, addressed boating and other water regulations, meals and lodging, moving expenses for dependents, and uniform allowance. It also amended the Freedom of Information Act in terms of exceptions, and amended the Act of August, 1935 concerning the Secretary's Advisory Board dealing with preservation of historic sites.

THE AMERICAN INDIAN RELIGIOUS FREEDOM ACT

(P.L. 95-341, 42 U.S.C. 1966, July 27, 1978)

This Act formalized Congress's recognition that Native Americans have an inherent right to the free exercise of their religion. It was based on a background of laws, regulations, and government policies that allowed infringement in the practice of native traditional religions. Many of these laws embody principles of land management and resource preservation. But, because these such laws were not intended to relate to religion and because there was a lack of awareness of their effect on religion, Congress neglected to fully consider the impact on Indian religious practices.

Federal activities that have infringed upon Indian Religious freedoms generally involve restrictions or denials of access to certain physical locations, restrictions on use of substances, use of bird and animal remains, and actual interference in religious events.

The purpose of the Act is to insure that the policies and procedures of various Federal agencies, as they may impact upon the exercise of traditional Indian religious practices, are brought into compliance with the constitutional injunction that Congress shall make no laws abridging the free exercise of religion.

Section I of the statute declares a policy to protect and preserve for American Indians their inherent right of freedom to believe, express and exercise the traditional religion of the American Indian, Eskimo, Aleut, and the Hawaiian Native, in the practice of their traditional forms of religion. Such protection will include but not be limited to access to sites, use and possession of sacred objects, and the freedom to worship through ceremonial and traditional rights.

Section 2 directs the President to evaluate Federal policy and procedures in consultation with native religious leaders in order to determine whether appropriate changes are necessary to protect native American religious rights. The President was requested to report his findings to Congress and did so in August, 1979.

Park Responsibilities

The statute imposes no specific substantive or procedural duties upon federal agencies. It simply states that Indians enjoy first amendment rights, as do all people in the United States, to the extent that Indian religious concerns are at issue in a given Departmental project program. Those concerns should be accommodated or addressed under NEPA or other appropriate statutes.

EXECUTIVE ORDERS 11989 and 11644 - OFF-ROAD VEHICLES ON PUBLIC LANDS

Prompted by widespread and increasing use by an estimated 5 million off-road recreation vehicles (motorcycles, minibikes, trail bikes, snowmobiles, dune-buggies, all-terrain vehicles, and others) President Richard Nixon issued Executive Order 11644 on February 9, 1972. The purpose of this order was to establish policies and provide for procedures that will ensure that the use of off-road vehicles on public lands will be controlled and directed so as to protect the resources of those lands, to promote the safety of all users, and to minimize conflicts among various uses. Generally, this Executive Order called upon agency head to develop regulations concerning designation of off-road vehicle trails in accordance with the following criteria:

- (1) Areas and trails shall be located to minimize damage to soil, watershed, vegetation, or other resources.
- (2) Areas and trails shall be located to minimize harassment of wildlife or significant disruption of wildlife habitats.
- (3) Areas and trails shall be located to minimize conflicts between off-road vehicle use and other recreational uses.
- (4) Areas and trails shall not be located in designated Wilderness or Primitive Areas - AREAS AND TRAILS SHALL BE LOCATED IN AREAS OF THE NATIONAL PARK SYSTEM, NATURAL AREAS, OR NATIONAL WILDLIFE REFUGES AND GAME RANGES ONLY IF THE RESPECTIVE AGENCY HEAD DETERMINES THAT OFF-ROAD VEHICLE USE IN SUCH LOCATIONS WILL NOT ADVERSELY AFFECT THEIR NATURAL, AESTHETIC, OR SCENIC VALUES.
- (5) The respective agency head shall ensure adequate opportunity for public participation in the promulgation of such regulations.
- (6) The respective agency head shall monitor the effects of the use of off-road vehicles on lands under their jurisdiction.

The Council on Environmental Quality shall maintain a continuing review of the implementation of this Order.

On May 24, 1977, President Jimmy Carter issued Executive Order 11989 amending Executive Order 11644 in order to clarify agency authority to define zones of use by off-road vehicles on public lands, and in furtherance of the National Environmental Policy Act. This amendment addressed two things:

1. Specifically defined official administrative use of off-road vehicles to fire, military, emergency or law enforcement vehicle when used for emergency purposes, and any combat or combat support vehicle when used for national defense purposes.
2. Directs agency heads to IMMEDIATELY CLOSE ORV routes whenever considerable adverse effects on the soil, vegetation, wildlife, wildlife habitat or cultural or historic resources are identified. Such closures will remain in effect until such time as he determines that the adverse effects have been eliminated and that measures have been implemented to prevent recurrence.

INTEGRATED PEST MANAGEMENT

A wide variety of plant and animal "pests" damage park resources or pose threats of injury or illness to humans.

The traditional response to the presence of rats, mice, cockroaches, flies, poison ivy, kudzu, etc., has been to apply chemical poisons, often on a repeated basis.

This approach is now considered "wrong" because:

1. even tiny amounts of chemicals can have devastating effects on other living things.
2. some pests develop resistance - or even complete immunity - to a pesticide.
3. the natural enemies of a pest are killed and the pest problem actually increases.
4. human error in application led to excessive quantities of poison in the wrong places.

The National Park Service has adopted a new approach to pest control called INTEGRATED PEST MANAGEMENT. It can be defined as a way of making decisions about managing pests in the context of the total environment. IPM emphasizes the use of natural controls.

The key steps in the IPM process include:

- Monitoring. . . collecting information on the target pest, its habitat, its impacts, and the ecology of its natural enemies.
- Setting the injury level. . . identifying the size of the pest population beyond which unacceptable impact will occur to resources or people.
- Treatment strategies. . . determining where and when pest treatment is needed. Identifying a strategy that (1) complements natural controls; (2) has the least impact on the natural and human environment; (3) is relatively inexpensive and easy to apply; (4) and may permanently reduce the target pest population.
- Program evaluation. . . effectiveness of all resources management programs must always be measured, and adjustments made when necessary.
- Education and communication. . . the public, and the park staff, should be made aware of highly visible or controversial pest management activities. More important, they should be educated towards more tolerance of non-harmful pest levels.

Finally, successful implementation of an IPM program involves all divisions and disciplines in a Park.

HOW DO WE MANAGE NATURAL RESOURCES?
A Planning and Problem Solving Process

I. PLANNING DOCUMENTS THAT GUIDE NRM

A. STATEMENT FOR MANAGEMENT

1. Provides a current summary of the state of the park.
2. Guides the parks short and long term management.
3. Aids in determining the nature and extent of planning required to meet the park's management objectives.
4. Contains:
 - a. information on the purpose of the park
 - b. significance of park resources
 - c. existing land management and use
 - d. legislative and administrative influences
 - e. management objectives
 - f. appendix with a copy of enabling documents

B. GENERAL MANAGEMENT PLAN

1. Contains short and long term strategies for:
 - a. resources management
 - b. visitor use
 - c. park development
2. Divides the park into zones according to future management emphasis. Zones include:
 - a. Natural
 - b. Historic
 - c. Park Development
 - d. Special Use

C. RESOURCES MANAGEMENT PLAN

1. Provide detailed guidance for a particular area of park management or the use of a particular geographic area of a park. Must be consistent with GMP.
2. Examples include:
 - a. Historic Structure Reports
 - b. Interpretive Prospectuses
 - c. Development Concept Plans

d. SPECIFIC "ACTION" PLANS

1. Document the extent of an area's natural and cultural resources.
2. Provide overall direction for their management.
3. Are one of the best sources of information on resource problems and how they are being approached.

THE ROLE AND FUNCTIONS OF A PARK'S RESOURCE MANAGEMENT PLAN

1. IS BASED UPON AREA MANAGEMENT OBJECTIVES.
2. DOCUMENTS THE AREA'S RESOURCE MANAGEMENT PROGRAM BY DESCRIBING ALL CURRENT AND ANTICIPATED ACTIVITIES FOR MANAGING THE PARK'S NATURAL RESOURCES.
3. PROVIDES A SYSTEMATIC APPROACH TO PROBLEM SOLVING.
4. SUMMARIZES THE STATUS OF EACH PARK'S RESOURCES, TRENDS AND DYNAMICS.
5. PRIORITIZES PARK'S NATURAL RESOURCE MANAGEMENT NEEDS.
6. IDENTIFIES RESEARCH, MONITORING, AND HANDS ON MANAGEMENT NEEDS.
7. REPRESENTS A "CONTRACT" BETWEEN THE REGIONAL DIRECTOR AND SUPERINTENDENT THAT CAN BE USED TO MEASURE ACTUAL ACCOMPLISHMENTS AGAINST COMMITMENTS.
8. FUNCTIONS AS AN EDUCATIONAL TOOL AND INTRODUCTION TO AREA FOR NEW EMPLOYEES BY OUTLINING WHAT THE PROBLEMS ARE AND HOW THEY ARE BEING APPROACHED.
9. CAN BE USED TO GENERATE UNIVERSITY INTEREST IN PARK RESEARCH PROJECTS.
10. SPANS THE TENURE OF MANY RESOURCE MANAGERS.
11. SERVES AS A BASIS FOR PROGRAMMING AND BUDGET.
12. CAN BE REVISED TO REFLECT ACCOMPLISHMENTS, RESULTS OF RESEARCH AND MONITORING, AND CHANGES IN PUBLIC OPINION.
13. SERVES AS A BEACON UPON WHICH ALL OF A PARK'S ACTIVITIES CAN ORIENT AND GAIN DIRECTION.
14. WON'T WORK UNLESS PEOPLE USE IT!!

II. PROBLEM SOLVING PROCESS

A. _____

1. Checklist:

- a. does the identified natural resource problem deal with the real purpose of the park?
- b. is it a resource management issue?
- c. is it a social issue?
- d. is the cause of the problem known?

B. _____

1. Definition of the problem:

- a. ecological perspective
- b. legislative/policy perspective
- c. political perspective
- d. public perspective

Checklist:

- is baseline information available?
- what is the history of the problem?
- do you need research to document the extent, course, impacts or significance of the problem?
- do you need research into methods for solving the problem?
- is the problem affecting more than one resource?
- what is known about the views of: park managers, park users, park neighbors, government agencies, special interest groups?

2. Solicit input from a variety of sources:

- a. brainstorming among divisions within the park
- b. consult "specialist" in Region and WASO
- c. contact other parks, agencies, groups with similar problems

C. _____

1. Checklist:

- a. does the suggested action fight against ecological principles?
- b. will the alternative reduce the impact to the resources?
- c. will the alternative cause impacts to other resources?
- d. are there any political impacts?
- e. will the alternatives produce a LONG TERM solution?
- f. does the solution require restructuring standard operating procedures, locations of facilities, etc., and, if so, does the willingness to change exist?

D. _____

1. May be important throughout the entire process.
2. Must also consider political realities.
3. May involve several "publics".

E. _____

1. Guided by regulations promulgated by Department of Interior and NPS.

F. _____

1. Identify resources needed: time, people, money
2. Identify sources of dollars and people
3. Develop a timetable with benchmark goals
4. Assign responsibility/accountability

G. _____

1. Tracking money
2. Monitor for effectiveness
3. Feed results back into the system

PROBLEM: Rehabilitation of Eagles Point, Golden Gate NRA

Eagles Point is located in the city of San Francisco. It is a site of approximately two acres which extends into the Golden Gate Channel. From the Point, visitors have one of the best views of the Golden Gate Bridge and the Marin Headlands. Due to its spectacular vista, and proximity to a large urban population, thousands of visitors walk to the Point to enjoy the view. As a result, vegetation was trampled, eliminating the ground cover. With ground cover gone, the highly erodable soils quickly eroded in the high winds and winter rains of this maritime environment. Three to five feet of top soil was eroded away and large gullies developed. Root systems of 28 non-native Monterey Pine trees located at the site were exposed, which resulted in their death.

With unrestricted pedestrian traffic increasing, and ground cover destroyed beyond its natural abilities to regenerate, management action was needed to solve this problem.

What would you do?

PROBLEM: Excessive and uncontrolled visitor use on fragile alpine ecosystems in Rocky Mountain National Park

Visitor use in Rocky Mountain National Park is very intense during the short summer season. It is concentrated along the main highway over the Continental Divide and on trails and lakeshores within a few miles of the roads. Along roadsides, particularly next to parking areas, visitors radiate to such attractions as snowbanks, "highpoints" for photos, etc. Over the years, trails have been constructed to allow access to points of interest. Many of these have become "braided" - i.e., formation of several parallel trails as hikers avoid ruts, snow, mud, or simply walk side-by-side. A number of "social" trails have also evolved as visitors establish their own routes.

Vegetation in the alpine zones is quite fragile and subject to a very short growing season. It takes a long time and strong protection before an impacted area will regenerate.

Park resources management objectives give high priority to restoration of impacted areas. How would you approach this project?

PROBLEM: Non-native goats and pigs in Hawaii Volcanoes National Park

The Hawaiian Islands are among the most isolated island groups in the world. Consequently, the plants and animals that arrived and evolved naturally did so at a very slow rate. Beginning with the first "Hawaiians," and accelerating with the arrival of "continental" peoples, thousands of non-native species have been introduced from other ecosystems. Animals such as cattle, pigs, cats, dogs, mongooses, and rats were also added to an environment which, prior to the arrival of the Polynesians, had known no land mammals other than the Hawaiian bat.

Goats were originally released on the Island of Hawaii in 1778. By 1850, they had reproduced and spread throughout much of the Island; they have devastated native plant species, eliminating many and creating barren environments that encouraged invasion by non-native plants. Shrub and grassland communities were being destroyed at an accelerating rate; soil erosion was also increasing. Over 70,000 goats were eliminated in the Park from 1927 to 1970 by various methods; however, when goat populations are reduced in the Park, more animals enter from neighboring lands. In 1970, aerial census indicated that about 15,000 goats were in the Park.

Wild pigs ~~were~~ introduced to the Islands from central Europe in the late 1700's. There are now about 4,000 pigs widely dispersed in the rain forest and open woodlands. Their impact on native plant and animal communities has been devastating. They root about the forest floor, eating a variety of native plants and overturning soil in search of invertebrates. This churned up soil becomes a seedbed for exotic plants. Their wallows collect water and become breeding places for mosquitoes, which transmit malaria and pox to native birds. The forest with pigs in it is less diverse and less stable than the forest without pigs.

How would you develop a long-term systematic approach to eliminating both of these non-native animals?

PROBLEM: Non-native mountain goats in Olympic National Park

The mountain goat is a large plant-eating animal native to the Cascade Mountains in central Washington, Idaho and Montana as well as western Canada and Alaska. In the late 1920's several pairs of these animals were introduced in the central Olympic Mountains. This was before establishment of Olympic National Park and it was anticipated that goats would thrive as game animals for hunters and simply as a symbol of alpine wilderness. About 13 years after the first transplants, the Park was established and hunting stopped.

In 50 years, mountain goats increased in numbers to almost 700, and spread throughout the Olympic Peninsula, mostly within Olympic National Park. The goats are significantly changing native plant communities. Preferred food species are intensively grazed and have been reduced in number; trampling has eliminated mosses and lichens as a soil stabilizing surface in many areas; wallows up to 30 feet in diameter have formed where goats paw the soil to create resting places or to dust bathe. Without management action, the goat population would continue to increase. Many native plants and animals would be displaced, reduced, or eliminated.

There is considerable public interest in the fate of the mountain goats in Olympic National Park.

How would you approach the problem?

CHECKLIST FOR DEVELOPING A PARKWIDE NATURAL RESOURCE MANAGEMENT PROGRAM

1. WATER RESOURCES MANAGEMENT

QUALITY

QUANTITY

HEALTH AND SAFETY

WETLANDS

FLOODING

WATER RIGHTS

2. AIR RESOURCES MANAGEMENT

3. FISHERIES

RECREATIONAL FISHING

HABITAT AND DIVERSITY

COMMERCIAL FISHING

4. WILDLIFE MANAGEMENT

REINTRODUCTION OF NATIVE SPECIES

POPULATION DYNAMICS

HABITAT PRESERVATION

HUNTING/TRAPPING

5. VEGETATION MANAGEMENT

HABITAT PRESERVATION

SPECIES DIVERSITY

INSECT AND DISEASE CONTROL

EXOTICS

SPECIES/HABITAT RESTORATION

6. FIRE MANAGEMENT

PRESCRIPTION

SUPPRESSION

7. VISITOR USE ZONE MANAGEMENT

FRONT COUNTRY

BACK COUNTRY

WILDERNESS

RIVER

8. ENDANGERED/THREATENED SPECIES MANAGEMENT

CRITICAL HABITAT PRESERVATION

MONITORING

9. MINERALS MANAGEMENT

10. HISTORIC SCENE MANAGEMENT

11. COSTAL PROCESSES MANAGEMENT

12. CAVE MANAGEMENT

SOME "ALL-PURPOSE" KSA'S FOR NATURAL RESOURCE MANAGEMENT

1. KNOWLEDGE OF PARK RESOURCES AND MANAGEMENT OBJECTIVES.
2. ABILITY TO OBSERVE AND ANALYZE FROM AN ECOLOGICALLY SENSITIVE PERSPECTIVE.
3. KNOWLEDGE OF RESOURCE CONDITIONS BASED ON ACTIVE AND FREQUENT CONTACT WITH THE RESOURCES.
4. ABILITY TO RECOGNIZE RESOURCE PROBLEMS BASED ON 1, 2 AND 3 ABOVE.
5. ABILITY TO CONDUCT A LITERATURE SURVEY FOR BASELINE INFORMATION.
6. SKILLS IN MAP READING AND ORIENTEERING.
7. ABILITY TO WRITE CONCISE AND ACCURATE REPORTS AND FIELD OBSERVATIONS, AND STORE INFORMATION SO THAT IT IS RETRIEVABLE.
8. ABILITY TO COMMUNICATE, ESPECIALLY LISTEN.
9. BASIC SKILLS IN PHOTOGRAPHY, FOR PHOTO DOCUMENTATION.
10. OPTIMISM, PERSEVERANCE AND PATIENCE.

TIDBITS

NRM IS AN ART AND YOU ARE THE ARTIST.

NRM IS FUELED BY IDEAS, DRIVEN BY CREATIVITY, AND DEMANDS PERSISTENCE.

RIGHT BRAIN THINKING IS AN ASSET.

EVERY EMPLOYEE IN EVERY DIVISION IS IN A POSITION TO MAKE A POSITIVE CONTRIBUTION TO THEIR PARK'S NATURAL RESOURCE MANAGEMENT PROGRAM.

THE VALUE JUDGEMENT OF "GOOD" OR "BAD" IS NOT IMPLICIT IN THE WORD "NATURAL".

IN THE BEGINNING....WERE THE RESOURCES.

WHEN YOU ARE TRYING TO SOLVE A NATURAL RESOURCE PROBLEM, DO SOME OF YOUR THINKING SITTING IN THE MIDDLE OF THE NATURAL RESOURCE.

IF YOU ARE FLOUNDERING IN SEARCH OF ANSWERS RECONSIDER THE QUESTION.

THE ONLY THING THAT'S DISTINCTLY BLACK AND WHITE IS A ZEBRA.

IT'S NOT CHEAP TO FIGHT MOTHER NATURE.

SIMPLE PROTECTION OF NATURAL RESOURCES BY DEFINING BOUNDARIES IS A VERY WEAK PRESERVATION TOOL, IF IT STANDS ALONE.

IT IS IMPERATIVE THAT ALL ARCHITECTS OF HISTORIC SCENE RESTORATION, REMOVE THEIR ROSE COLORED GLASSES BEFORE BEGINNING WORK.

IF LEOPOLD'S VIGNETTE OF PRIMITIVE AMERICA IS AN IMPOSSIBLE DREAM, THEN WE MUST ALL BE DON QUIXOTES.

December 27, 1984

REGIONAL RESOURCE MANAGEMENT CONTACTS

National Capital Regional Office
National Park Service
1100 Ohio Drive, S.W.
Washington, D.C. 20242
8 - 472-7996

Rocky Mountain Regional Office
National Park Service
655 Parfet Street
P.O. Box 25287
Denver, CO 80225
8 - 776-8646

Southeast Regional Office
National Park Service
75 Spring St., S.W.
Atlanta, GA 30303
8 - 242-4916

Western Regional Office
National Park Service
450 Golden Gate Ave.
San Francisco, CA 94102
8 - 556-8373

Southwest Regional Office
National Park Service
Old Santa Fe Trail
P.O. Box 728
Santa Fe, NM 87501
(505) 988-6412 or 8 - 476-6412

Pacific Northwest Regional Office
National Park Service
83 South King Street
Suite 212
Seattle, WA 98104
8 - 399-5670

Alaska Regional Office
National Park Service
2525 Gambell Street, Room 107
Anchorage, AK 99503
(907) 271-4212

North Atlantic Regional Office
National Park Service
15 State Street
Boston, MA 02109
8 - 223-3775

Midwest Regional Office
National Park Service
1709 Jackson Street
Omaha, NE 68102
8 - 864-3476

Mid-Atlantic Regional Office
National Park Service
143 South Third Street
Philadelphia, PA 19106
8 - 597-5372

<u>REGION</u>	<u>CPSU</u>	<u>NPS CONTACT</u>	<u>UNIVERSITY CONTACT</u>	<u>STATUS</u>
SER	Clemson University Department Head Parks, Recreation, and Tourism Mgmt. Clemson University Clemson, South Carolina 29631	Dominic Dottavio (803) 656-2182	Dr. Herbert Brantley (803) 656-3036	Active
	University of Georgia Institute of Ecology University of Georgia Athens, Georgia 30608	Susan P. Bratton (404) 542-2968	Dr. James Cooley (404) 542-2968	Active
MWR	Michigan Technological University Houghton, Michigan 49931	Dr. J. Robert Stottlemeyer (906) 487-2478	NONE	Active
SWR	Texas A&M University Department of Recreation & Parks College Station, Texas 77843	Dr. Denny Fenn (409) 845-5369	Dr. Leslie Reid (713) 845-7323	Active
RMR	Colorado State University College of Forestry and Natural Res. Colorado State University Ft. Collins, Colorado 80523	NONE	Dr. Harry E. Troxell (303) 491-6675	Active
	University of Wyoming Box 3166 University Station Laramie, Wyoming 82071	NONE	Dr. Kenneth L. Diem (307) 766-4207	Active
	Utah State University Department of Forest Resource College of Natural Resources UMC 52 Utah State University Logan, Utah 84322	NONE	Dr. Richard F. Fisher (801) 750-2455	Inactive

<u>REGION</u>	<u>CPSU</u>	<u>NPS CONTACT</u>	<u>UNIVERSITY CONTACT</u>	<u>STATUS</u>
NAR	College of the Atlantic Bar Harbor Maine 04609	Dr. Michael Soukup 8 - 223-7765	Dr. William Drury (207) 288-5015	Active
	Rutgers University Center for Coastal and Environmental Studies The State University of New Jersey Doolittle Hall New Brunswick, New Jersey 08903	Dr. Paul Buckley 8 - 342-5389 or commercial no. (201) 221-1824	Dr. Norbert Psuty (201) 932-3738	Active
	State University of New York College of Environmental Science and Forestry Syracuse, New York 13210	Dr. Michael Soukup 8 - 223-7765	Dr. Bill Porter (315) 470-6798	Active
	University of Massachusetts Department of Forestry & Wildlife Mgt. Holdsworth Hall Amherst, Massachusetts 01003	Dr. Michael Soukup 8 - 223-7765	Dr. Bill Patterson (413) 545-2666	Active
MAR	University of Pennsylvania Morris Arboretum University of Pennsylvania 9414 Meadowbrook Avenue Philadelphia, PA 19118	None	Dr. Ann Rhoads (215) 247-5777	Active
	University of Virginia Department of Environmental Sciences Charlottesville, VA 22903	None	Dr. Robert Dolan (804) 924-7761	Active
	Pennsylvania State University 208 Ferguson Building The Pennsylvania State University University Park, PA 16802	Mr. John F. Karish (814) 865-7974	Dr. Brian J. Turner (814) 865-1602	Active
NCR	NONE	NONE	NONE	NONE

<u>REGION</u>	<u>CPSU</u>	<u>NPS CONTACT</u>	<u>UNIVERSITY CONTACT</u>	<u>STATUS</u>
WR	University of California Department of Land, Air & Water Res. University of California Davis, CA 95616	Dr. Charles van Riper III (916) 752-7119 Dr. Christine Schonewald-Cox (916) 752-7119 Dr. Gary Davis (805) 644-8157 Dr. David Parsons (209) 565-3341 Dr. David Graber (209) 565-3341 Dr. Gary Fellers (415) 663-8522 Dr. Jan van Wagtendonk 8 - 448-4465 Mr. Stephen Veirs (707) 822-7611 Dr. William Halvorson (805) 644-8157	Dr. Lynn D. Whittig (916) 752-0765	Active
AK	NONE	NONE	NONE	NONE

<u>REGION</u>	<u>CPSU</u>	<u>NPS</u>	<u>ACT</u>	<u>UNIVERSITY CONTACT</u>	<u>STATUS</u>
PNR	University of Idaho College of Forestry University of Idaho Moscow, Idaho 83843	Dr. R. Gerald Wright 8 - 554-1111 ask for # (208) 885-7990 Dr. Gary E. Machlis 8 - 554-1111 ask for # (208) 885-7129		Dr. John R. Erhenreich, Dean (208) 885-6442	Active
	Oregon State University School of Forestry Oregon State University Corvallis, OR 97331	Dr. Edward E. Starkey (503) 754-2056 Dr. Donald R. Field (503) 754-2056 Dr. Gary Larson (503) 757-4668		Dean Carl H. Stoltenberg (503) 754-2221	Active
	University of Washington College of Forest Resources Seattle, Washington, 98195	Dr. James K. Agee (206) 543-2688 Mr. Darryll R. Johnson (206) 545-7404		Dean David B. Thorud (206) 545-1928	Active
WR	University of Arizona 125 Biological Science (East) Building 43 University of Arizona Tuscon, Arizona 85721	Dr. R. Roy Johnson 8 - 762-6886 Dr. Heaton Underhill 8 - 762-6919 Mr. Peter Bennett (602) 629-6985 Dr. Steven Carothers (602) 774-5500		NONE	Active
	University of Nevada Department of Biological Science Las Vegas, Nevada 89154	Dr. Charles Douglass 8 - 598-6468		NONE	Active
	University of Hawaii Department of Botany University of Hawaii Honolulu, HI 96822	Dr. Donald Gardner (808) 948-8218 Dr. Lloyd Loope (808) 572-1983 Dr. Charles Stone (808) 967-8211		Dr. Clifford W. Smith (808) 948-8218	Active

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