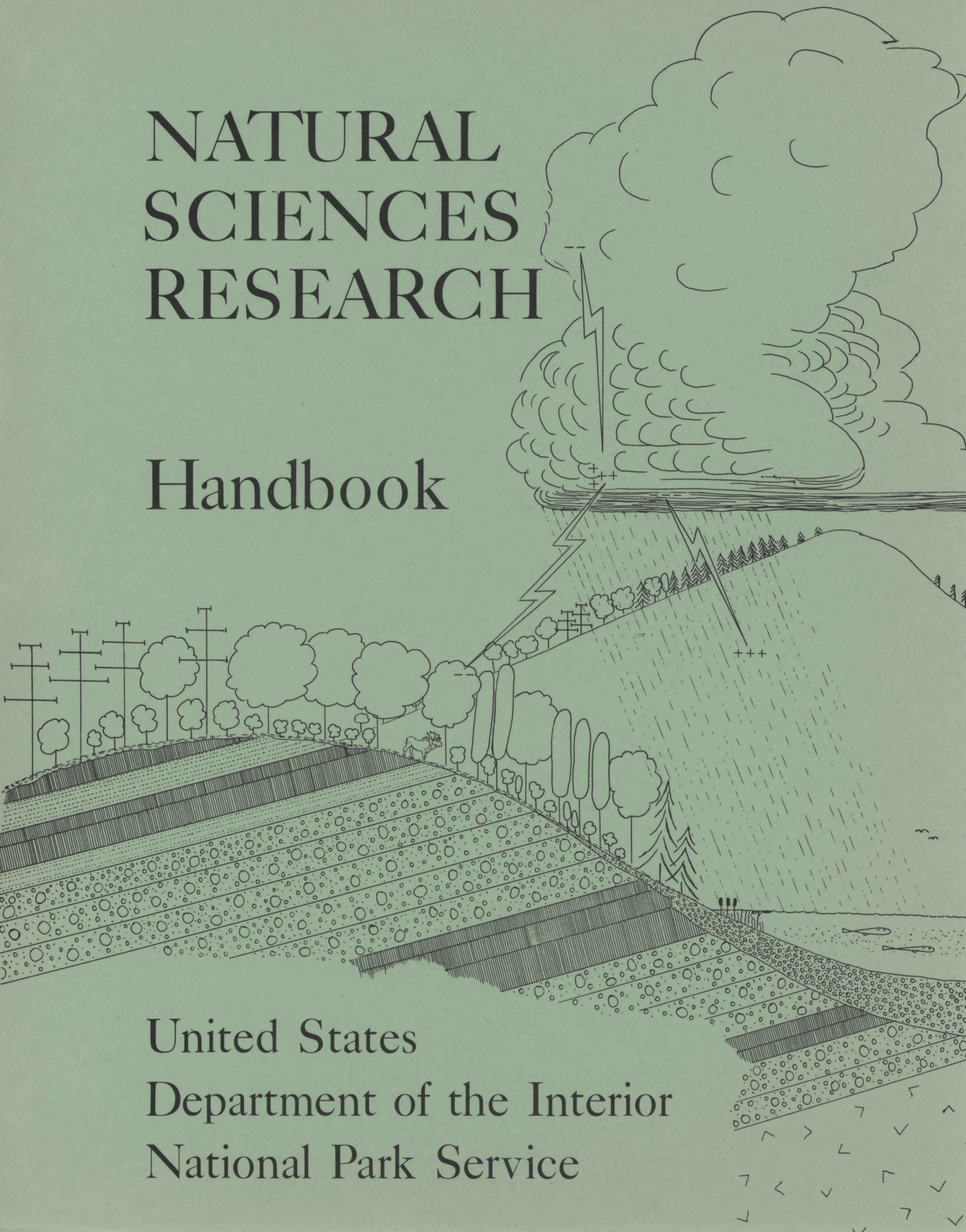
NATURAL SCIENCES RESEARCH

Handbook



United States
Department of the Interior
National Park Service

NATIONAL PARK SERVICE

HANDBOOK

NATURAL SCIENCES RESEARCH

RELEASE NO. 1
July 27, 1965

The Division of Natural Sciences Studies has been the natural sciences research arm of the Service since the early winter of 1963. In the little more than a year since that time several directives have been issued concerning the procedures for initiating and carrying out needed research projects in the various parks.

It soon became apparent that natural science research in the parks needed integrated planning in order to be most effective toward fulfilling the purposes of research: to supply park administrators with facts and knowledge that permit wise administrative decisions to be made concerning natural areas and phenomena, and to provide the basic facts and knowledge necessary to the management and interpretation of park natural resources. This handbook is meant to furnish purpose, direction and coordination in the natural sciences research program. The first four chapters, which are short, should become familiar to all Service employees; the subsequent chapters are specifically written for those employees engaged in some aspect of natural sciences research.

The present release consists of the first 4 chapters of the handbook. These chapters provide the basic philosophy and an outline of the procedures for the natural sciences research program. Additional chapters will be issued at a later date that will provide greater detail for various aspects of the program.

Distribution is being made to all field, regional, Design and Construction Offices, and WASO Division Offices. Additional copies may be obtained by filling in the tear-off section below and sending it to the Washington Office.

When the first 8 chapters have been received, this handbook will replace all previous directives concerning the natural sciences research program.

W. D. Bahlman

Acting Assistant Director

Enclosure

Interior - Duplicating Section - Washington, D. C.

FOREWORD

This handbook (1) expresses some general concepts, (2) describes the overall process, (3) sets forth the procedures to be followed, and (4) outlines the requirements for preparation of the various instruments used in carrying out a research program for a park.

Chapter 1: discusses Research in General, as applicable to National Parks.

Chapter 2: summarizes the general Principles and Objectives in accordance with present thinking.

Chapter 3: presents an overview of the Research Process from beginning to end.

Chapter 4: outlines the Procedures that are involved, and identifies the office primarily responsible for each phase.

The remaining chapters deal specifically with the how-to-do -- the Park Research Plan, the Resource Studies Problem, the Natural Sciences Proposal, various reports, etc.

Chapters 1 to 4 will be of interest to all personnel--a frame of reference for a better understanding of what research is about, and how the program is carried out. The remaining chapters will be most useful to personnel who themselves have a specific job to do in this field.

CONTENTS

RESEARCH IN GENERAL

Prologue

The owner of a new automobile enjoys a period of grace. He can drive it from coast-to-coast with no knowledge whatsoever of how any of the complicated parts of that machine work. But, sooner or later, the car must come under the eye and hand of a mechanic, thoroughly familiar with every interrelated part and function, who can diagnose its condition, and make the necessary adjustments and repairs. Otherwise, the car may be driven to ruination.

For most of their years, the National Parks, too, enjoyed a period of grace. Comparatively isolated, and under moderate use, they were almost self-maintaining. Even today, the beauty of the National Parks can be intensely enjoyed in the absence of any factual knowledge about them. For a while, they can be managed passively, by drawing boundaries around them, and by controlling fires and other destructive influences.

Without man and his civilization, the natural scene, unlike the automobile, would continue to perpetuate itself--changing only in response to natural climatic and evolutionary changes.

But the parks are being used by man, and his civilization directly and indirectly effect unnatural changes upon the natural scene. These changes occur in a system infinitely more complex than the most sophisticated machine devised by man. Yet, like the machine, parts of the system begin to wear and malfunction in response to the impact of a civilization. The ecological system, like the machine, comes to need specialized attention, too, in judging its condition, diagnosing what has gone wrong, and prescribing and developing data to back up adjustments in use and management.

The Mission--Natural Sciences Research

The natural areas of the National Park System contain some of the largest and best examples of the original American landscape. They constitute an invaluable, irreplaceable resource for recreation, education, and scientific research.

The Mission--Natural Sciences Research (con.)

The National Parks are complex natural systems. They are extremely varied in geologic, plant, animal, and other natural features. Moreover, ecological patterns within them continuously develop and change under the influence of both nature and man. The interrelations and interactions among elements of the environments, and of the forces at work within them, are exceedingly complex, frequently obscure, and incompletely understood. The results are seldom dramatic and obvious. Unnatural changes often approach irreversible stages before being recognized.

The National Parks are, in essence, ecological islands. Their insulation and areal limitation generate internal problems with respect to migratory species, predator and other population controls, habitat limitations, and other space-imposed factors.

Furthermore, these islands are impinged upon by forces resulting from the increasingly intensive use of bordering lands. Among them are fire, forest insect and disease infestation, exotic plant and animal invasions, stream pollution, predator control, overlapping ranges of domestic stock and wildlife, and the like.

Each year, additional millions of people seek recreation in areas of the National Park System. In their varied pursuits, and in the facilities which they require for access, accommodation and safety, they too impose an ever heavier impact on the natural environment.

Such forces, internal and external, affect the natural integrity of the park environment, and in some cases threaten the very existence of parks as vignettes of natural America.

Congress has directed and the Nation expects the natural areas of the National Park System to be safeguarded and preserved as natural communities of life.

Maintenance of the integrity of these natural properties is a practical requirement for their proper use. Their value for wilderness-based recreation, for organized and avocational education in the fields of natural science and conservation, and as a theater and outdoor laboratory for basic research, depends upon the maintenance of a high degree of integrity of the natural environments

The Mission--Natural Sciences Research (con.)

contained therein. Each unnatural change or impairment destroys a part of their capacity to serve these purposes.

The first basic task of the National Park Service is to manage these properties so as to neutralize and correct, to the greatest degree possible, all such unnatural influences--whether arising from unbalanced natural conditions and public use within, or whether invading the parks from without.

To do so means that the Service must understand, much more completely than it now does, the natural characteristics of these properties, the nature of the normal processes at work within and the unnatural forces imposed upon them and, as well, the relationships of park visitors to the natural environments. If the Service is to protect and preserve, it must know what it is protecting, and what it must protect against--develop the fund of knowledge necessary for effective management. Ecological knowledge is requisite to good management.

The need is for knowledge in support of the Park Mission--the preservation, restoration, and management of park natural resources, and their beneficial use by people.

One of the most far-reaching benefits of National Parks derives from their capacity to stimulate park visitors to a greater interest and awareness of the natural world of which they are a part. Scientific knowledge undergirds park resource management; but also, effectively interpreted, adds to visitor appreciation and enjoyment, and influences a better use of the National Parks.

National Parks are of increasing importance for basic research in the natural sciences. Through study of natural soils, flora, and fauna, science has contributed inestimably to forestry, agriculture, medicine, and other technologies. Man has much yet to learn and to profit from such research. Basic research in this respect is not within the National Park Service mission, but rather a function of universities and other research institutions. This concept does, however, impose an obligation upon the National Park Service for preservation management of a kind and degree quite beyond that required for any other class of public lands.

The Mission--Natural Sciences Research (con.)

The need is for knowledge. Research is a process by which that knowledge is obtained.

The Service's research program is mission-oriented, i.e. it focuses sharply upon those subject areas that encompass the significant features and purposes of each park, and upon the specific problems arising therefrom. More correctly, the program is one of basic research in mission-oriented fields, with a mission-oriented emphasis.

RESEARCH IN THE NATIONAL PARKS

National Park Service thinking about research is assuming a new dimension. New patterns of organization and procedure have been established, and will continue to develop. Plans, procedures, instructions, and guidelines, in some detail, are, of course, required.

But, if the details are to be consistent with each other, and if they are to add up to a system that is logical and sharply focused, they must derive from general concepts about how research fits into the scheme of National Park affairs, and about the position toward which research should move.

The following brings together some of the concepts upon which this program is based, and gives some idea of the course ahead. These are not to be taken as firm and fixed ideas. Rather, perhaps they will help to establish a pattern of thought within which guidelines and plans can continue to develop.

1. National Parks include important scientific features, and their use for research by the scientific community, is to be encouraged and promoted.

2. The National Park Service requires research, complementing the above, but oriented within its own agency mission.

In content, the National Park Service research focuses inward upon park problems and, in general, limits itself to those disciplines that embrace the significant values, and the purposes for which each park area was established. For the most part, its focus is upon those subject areas which give rise to problems of preservation, restoration, resource management, interpretation, and public use. Insofar as they are recognized, individual studies are oriented toward specific problems in these fields. It is not basic research--"pure research"--in the academic sense. Neither is it applied research in the limited meaning in common usage. It is "basic" in methodology and in strategy, and it is "applied" in that the product should have real utility to the Service in carrying out its responsibilities. If it must have a label, it should be "mission-oriented research."

3. The primary function of the Service's research program is to report the facts objectively, as a contribution to the decision-making process.

Research is the extraction of new knowledge from or about park resources, and the analysis and interpretation of the findings. As a general principle, the research process, and the responsibility of Natural Sciences Studies, concludes with the submission of a research report to the appropriate office, together with an evaluation of its professional content and findings, and an interpretation of its implications to the problems that generated the study. Research per se does not, therefore, attempt to balance the scientific findings against consideration of cost, public policy and attitudes, or other administrative factors. Decision, based upon research findings as weighed against other considerations, is an administrative function. Carrying out the decision, and this often requires technical and professional skill apart from research, is a management function.

4. All arms of the Service are involved in the research process--all activities, and the Park, the Region, the Design Offices, and WASO.

The first and most important contribution to the program is in the identification of problems requiring research, and the area of Service's mission in which problems are anticipated. These arise particularly in resource management, interpretation, development, and public use, but derive as well from the findings and needs of the research program itself.

Close liaison between the research arm and other activities of the Service, at all subsequent stages, is necessary.

5. The Division of Natural Sciences Studies is the natural science research arm of the Service.

It is contemplated that all natural science research, regardless of by whom or by what funds, will come under the purview of Natural Sciences Studies, and be administered with the appropriate procedure.

Its primary functions are to translate the needs of the Service into coordinated research plans and specific project plans, to conduct the research, and to report upon the same. Secondarily, Natural Sciences Studies will render professional services, in support of other activities, preferably when described as project units, requested by work order or similar formal referral, and, where necessary, supported by transfer of funds.

6. The Service will seek to enlist the highest possible competence for the conduct of project research among (in order of priority):

a. National Park Service personnel.

b. Other Federal agencies.

c. Universities, independent research institutions, independent scientists.

7. The Service will seek to strengthen its own research competence, and to develop the research capabilities of Service personnel generally.

All qualified personnel will be encouraged to engage in research, either by assignment to a programmed study, by engaging in investigative work within the normal dimensions of their job assignment, or by undertaking projects conceived and pursued on the employee's own initiative and own time. Successful research conducted on an employee's own time and initiative should be given favorable recognition in the individual's permanent personnel records. It should also be considered for a possible cash award under the incentive awards program.

8. In full compliance with the requirements and the need for coordination, communication, and close liaison with all offices, Natural Sciences Studies may communicate directly with other personnel or offices on professional matters, and will assume full responsibility for the administration of the research program.

Basic natural science research planning, project planning and approval, contracts, authorization of funds allotments for personnel or projects, personnel actions involving Service personnel engaged in natural science research, and project supervision and evaluation, are among the administrative items that fall, primarily, within the purview of Natural Sciences Studies.

9. The research program will evolve from project-oriented studies, to a system-oriented program.

This will be accomplished through the development, park by park, of an overall research plan that takes into consideration the interdisciplinary character, not only of specific problems, but of

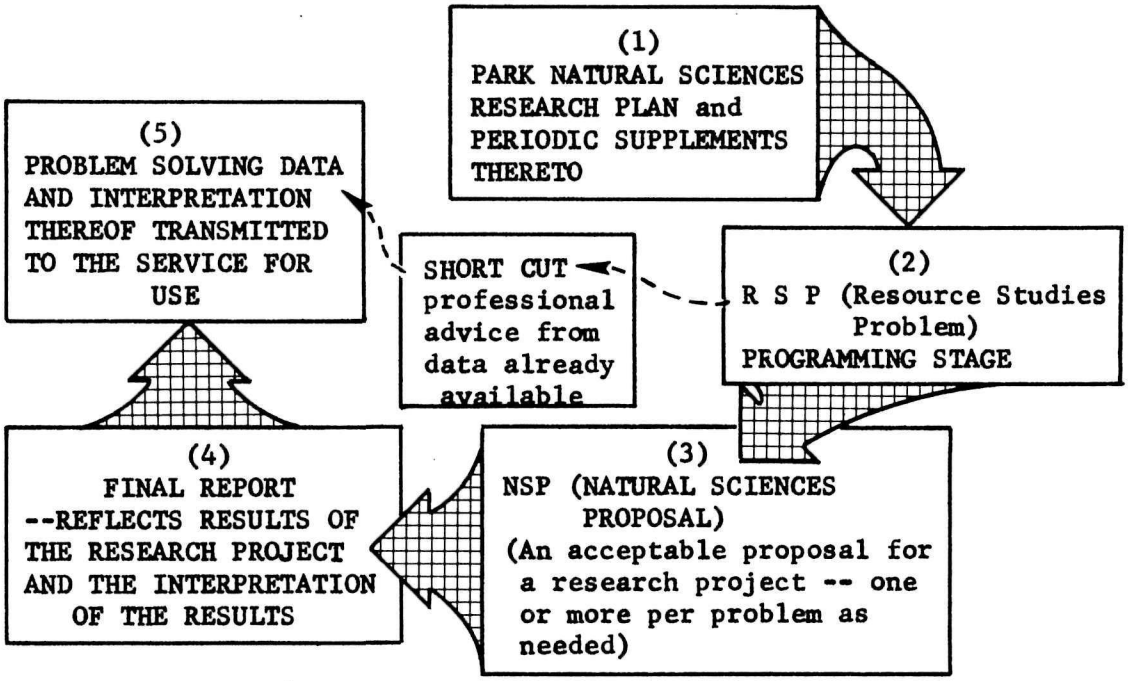
the overall, complex and interacting ecological character of the total natural community of a park.

For the most part, the future National Park Service sponsored project research for a park will be focused within the framework of the Park Natural Sciences Research Plan, and described for purposes of budgetary justifications, in its comprehensive dimensions.

A SUMMARY OF THE RESEARCH PROCESS

The following chapter summarizes the main steps required in planning and carrying out a park natural sciences research program.

The research process starts with a "master plan," (1) a Park Natural Sciences Research Plan (with periodic supplements of new material); each specific problem is identified and stated in the (2) Resource Studies Problem (RSP); then, professional advice is obtained for problems not requiring research; and, for problems requiring research, the specifications of each research project are described in (3) Natural Sciences Proposals; the studies are made and the results reflected in (4) Research Reports; finally the findings are (5) transmitted to the Service for use.



1. The Park Natural Sciences Research Plan ("the Plan"). (Detailed in chapter 5.) The research program must have its base in sound initial planning at the Park level. Such planning normally involves an ad hoc task force meeting in the Park, composed of

scientists and personnel from all appropriate arms and offices of the Service. Thus, coordination of the program, and the establishment of the research mission, within the framework of park objectives and needs, are jointly accomplished.

The Plan derives from a clear statement of management objectives expressed in terms of resources, problems, and specific purposes of each Park.

The Plan defines the research objectives, the research problem areas, and sets forth the research strategy. It is not essentially a list of projects, but may identify those studies first required. In brief, the Natural Sciences Research Plan broadly outlines the fields in which research is needed in the Park, establishes general patterns for the attack, and indicates the content and dimensions of the program.

The Park Natural Sciences Research Plan is the basic instrument governing the whole program:

a. To keep the Service-supported research program on the mission-oriented path and to indicate the direction and sequence of individual project studies.

b. To provide a basis for evaluating project proposals, and feedback of results.

c. To serve as the primary source for budget and congressional justification (as contrasted with a project-by-project approach).

d. To influence the nature of, and to secure greater participation in, research in the parks, whether done for the Service or independently, by other Federal research agencies, universities, or members of the scientific community.

e. To provide a basis for requests for grants from foundations and institutions.

Periodic supplements, comprised of additional information and new problems that arise after completion of the original Plan, will serve to keep the Plan current.

2. The Resource Studies Problem (RSP). (Detailed in chapter 6.) Each natural science problem confronting management and interpretation must be stated on an RSP form. Normally the problems are identified in the Plan. As they arise, new problems, not identified in the Plan, also are submitted as an RSP to secure professional advice and/or research support.

If adequate data for solving the problem do not exist, then the RSP becomes the basis upon which the required research projects are built. Depending upon the complexity of the problem, there may be one or more research projects that derive from a single RSP. (If data already exist for solving a problem, professional advice will be supplied and the initiation of a research project will be unnecessary.)

The problem that is judged to need further research is brought to the attention of an interested Service or other scientist in order that a research project or projects can be designed to solve it. The scientist then prepares and submits a Natural Sciences Proposal (or Proposals) covering the project.

3. The Natural Sciences Proposal ("the Proposal"). (Detailed in chapter 7.) The Proposal is prepared by the investigator, in collaboration with the appropriate Natural Sciences Studies representative, or other keyman assigned to the individual project and forwarded via the park to the Division of Natural Sciences, WASO. It states the specific problem and purpose of the individual study project, summarizes the status of knowledge pertinent to the problem, describes in substantial detail the project and the research methods to be followed, gives a breakdown of costs, personnel, and time requirements, and names the principal investigator and states his qualifications. Research is costly and before monies are obligated, the Service must be certain that the project has been thoroughly thought through, that the investigator is competent to do the job, that he understands what the Service expects from the study, and that the proposed approach promises to yield results.

Upon evaluation and approval, the Proposal becomes the primary instrument for programming, assigning, contracting, and supervising the research project.

4. The Final Report. (Detailed in chapter 8.) The product of the research project is a final report. The investigator's task is completed with the submission of a final report of scientific findings and, when required, a statement containing his recommendations as a scientist concerning the application of the findings to the problem(s) which gave rise to the study.

5. Application of Research Results. (Detailed in chapter 9.) The value of mission-oriented research is measured by the degree to which the results are valid and find application in Service programs. This involves two things: first, the results must be worth using and they must be brought to the attention of those who can use them. This is the job of Natural Sciences Studies. Second, someone does, indeed, make application of the results. This involves the management arms of the Service. Unless both Natural Sciences Studies and Management carry through, the Service will receive little value from its natural sciences research effort.

In theory, research presents the case from the standpoint of the scientific evidence. The administration weighs that evidence against other considerations and makes a decision. The manager effects the action indicated by the decision. It is useful to keep this theory of functions in mind, even though in practice and on occasion, research personnel may participate in the decision or assist in the management procedure. Likewise, the manager may himself do research, or decide what, if anything, to do with the results.

In brief, the investigator's report, when judged sound from the scientific standpoint, is released and forwarded by Natural Sciences Studies to appropriate offices, together with any further interpretation or analysis that may be useful. In turn, Natural Sciences Studies is informed of any decision or action taken as a result of this study so that the consequences can be observed and the problem situation reappraised after a suitable period of time.

PROCEDURES

The procedures for carrying out the Natural Sciences Studies program for a park, are outlined below. The actions are identified generally in the sequence in which they occur. Some may occur concurrently.

Only the highest office that has the basic responsibility for each action is identified herein. It is assumed (1) that the necessary further delegation of authority and assignment of tasks to support the action will be made, and (2) that the need for communications and liaison with other offices will be met at each stage of the procedure. [For example, in item 1-a below, it is assumed: (1) that the Assistant Director, Resource Studies, may delegate the responsibility for establishing schedules to the Chief Scientist; and (2) that in the establishing of schedules, the superintendents and regional directors of the parks involved will have been consulted. Likewise, in item 1-b, the superintendent may delegate the gathering of background data to his chief ranger, chief naturalist or other staff member.]

1. The Park Natural Sciences Research Plan ("the Plan"). (Described in chapter 5.)

   a. The Assistant Director, Resource Studies, establishes a schedule for the preparation of the Natural Sciences Research Plan for given parks.

   b. The Superintendent prepares and assembles background data on natural resources, state of knowledge relative to the resources, management objectives, and problems.

   c. The Chief Scientist implements the planning schedule, park by park. For each:

      (1) An ad hoc task force is formed, comprised of representatives of the superintendent, regional director and Director, as appropriate, and consultants.

      (2) A date is set, and arrangements are made for the task force to assemble in the park.

(3) A preliminary framework for the Plan is prepared.

(4) An agenda for the meeting is prepared.

d. Task Force, under the leadership of the Chief Scientist, assembles in the park and formulates and completes the research Plan to draft stage.

e. Chief Scientist distributes the completed Plan to:

Superintendent (2)
Regional Director (2)
Design and Construction Field Office (1)
Washington Office (5)

f. Superintendent, Regional Director, Design and Construction, and Washington Office Divisions comment upon the adequacy and implications of the Plan with respect to management, operations, development and administration.

Chief Scientist causes a review and an appraisal to be made of the scientific content and adequacy of the Plan.

g. Chief Scientist effects any needed revision of the Plan, and submits it for review by the NPS Advisory Committee for Natural Sciences.

h. Consulting Committee recommends approval.

i. Director approves the Plan.

j. Chief Scientist causes periodic reexamination of the Plan to be made, and schedules revision as needed.

2. The Resource Studies Problem (RSP). (Described in chapter 6.) The RSP in primarily an instrument for programming purposes and for recordkeeping. It derives from many sources within the Service:

a. The Chief Scientist prepares an RSP for each problem which derives from the Park Natural Sciences Research Plan and its supplements.

b. The Superintendent, Regional Director, Chief, Design and Construction Office, and appropriate WASO Divisions prepare RSPs identifying problems arising from current operations, development plans or special situations.

c. The Superintendent prepares an RSP form for each problem proposed to be studied independently by area personnel.

d. The head of the appropriate office (WASO, region, park) prepares an RSP for each problem proposed to be studied by other agencies or personnel.

e. The Chief Scientist, from data submitted in RSP form, develops the overall research program for a given program period of one or more years.

3. The Natural Sciences Proposal ("the Proposal"). (Described in chapter 7.)

a. The Chief Scientist seeks the most competent scientist (investigator) available from among Service personnel, other Government agencies, universities, etc., to prepare and carry out a research project designed to obtain the data necessary to solve the problem.

b. The Investigator prepares a detailed Natural Sciences Proposal with assistance as needed from the keyman, and distributes copies to:

Washington Office (10)
keyman (1)
park (1)
region (1)
Field Office, Design and Construction, if applicable (1)

(The investigator is the scientist who will conduct or direct the research project)

(The keyman, appointed for each problem or research project, is a Service employee, competent in the subject field of study and conveniently

located to the project site, who will exercise direct liaison with the study from time the project is programmed until the assignment or contract is completed)

c. Superintendent, Regional Director, Design and Construction, Washington Office Divisions as appropriate, review and comment with respect to management and administrative implications.

d. Chief Scientist causes review and appraisal to be made of scientific merit and adequacy.

Panel or individual consultants review specialized and complex Proposals referred to them by the Chief Scientist.

e. When necessary, Chief Scientist causes revision of the Proposal to be made.

f. Assistant Director, Resource Studies, approves the Proposal, causes funds to be allotted, assignment of personnel to the study to be made and/or contracts let.

4. The Research

a. The Investigator proceeds with the study, maintains direct liaison with the keyman, and prepares and submits progress and final reports as specified in the terms of the contract or assignment.

b. Keyman certifies or recommends certification of the completion of terms of the contract or assignment.

c. Keyman forwards the report, together with his evaluations, to Chief Scientist (in duplicate or other as specified) with one copy each, as appropriate, to:

Superintendent
Regional Director
Design and Construction Field Office

d. Any comments which any office may make upon their review of the report are forwarded directly to the Chief Scientist.

5. Application of Research Results

a. Chief Scientist reviews and evaluates final report for scientific content and validity, evaluates findings, and identifies implications of the findings that are of interest to National Park Service.

b. Chief Scientist transmits report, together with an evaluation and interpretation, to the Director, and appropriate Assistant Directors.

c. Director or appropriate Assistant Director authorizes the application of the findings within his area of responsibility, and informs Natural Sciences Studies of the actions recommended.