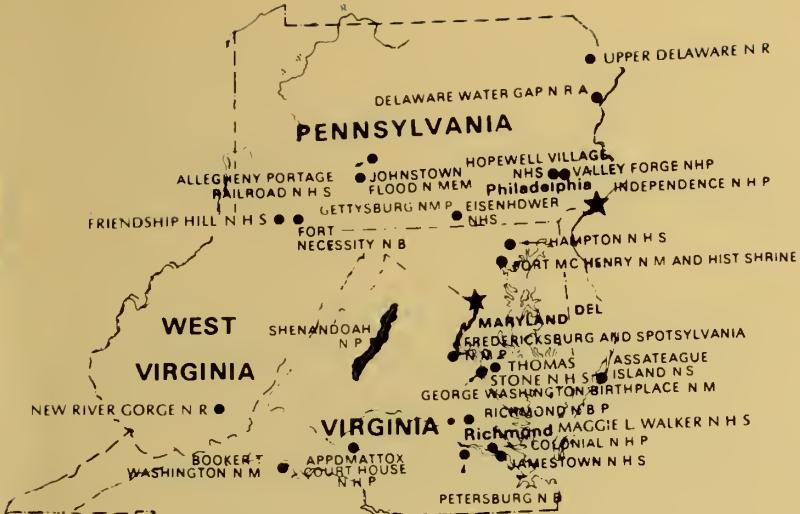


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MID-ATLANTIC REGION

RESEARCH/RESOURCES MANAGEMENT REPORT

A RESEARCH PLAN TO STUDY APPROPRIATE RIVER RECREATION USE ON THE

- Delaware Water Gap National Recreation Area
- New River Gorge National River
- Upper Delaware Scenic and Recreational River

U.S. DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE



MID-ATLANTIC REGIONAL OFFICE
143 SOUTH THIRD STREET
PHILADELPHIA, PENNSYLVANIA 19106

The Mid-Atlantic Region (MAR) of the National Park Service is the central administrative office for 28 park units in five states: Maryland, New Jersey, Pennsylvania, Virginia, and West Virginia. The diversity of parks and their resources is reflected in their designations as national parks, national seashores, national historic parks, national recreational areas, national military parks, and national rivers.

The MAR Branch of Resource Protection administers scientific consultation, research, and monitoring efforts in these parks, involving a wide range of biological, physical, and social sciences. The Research/Resources Management Series was established as a medium for distributing current scientific information obtained from studies designed to improve the management, protection and interpretation of park resources. Information contained in this Series is potentially useful to other Park Service areas outside the MAR and also benefits independent researchers working in the parks and elsewhere. The Series provides for the retention of research information and makes possible more complete in-house evaluation of internal research, technical, and consultant reports.

[Redacted]

The Series includes:

1. Research reports which directly address resource management problems in the parks.
2. Literature reviews and bibliographies of existing information relative to park resources or resource management problems.
3. Presentations of basic resource inventory data.
4. Other applicable reports relating to the research and resource management programs of the Mid-Atlantic Region.

Research/Resources Management Reports are produced in limited quantities and, as long as the supply lasts, copies may be obtained from the Branch of Resource Protection, Mid-Atlantic Region.

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Submitted to:

USDI National Park Service
Mid-Atlantic Region
Philadelphia, Pennsylvania

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EXECUTIVE SUMMARY

In 1984, the Mid-Atlantic Region of the National Park Service entered into a cooperative agreement with the U. S. Forest Service's North Central Forest Experiment Station to investigate river recreation use and carrying capacity on three rivers--the Upper Delaware Scenic and Recreational River, the Delaware Water Gap National Recreation Area, and the New River Gorge National River. The anticipated level and probable duration (3 or more years) of funding and the regional perspective of the study areas permit the design of a comprehensive, in-depth research program that will aid resource administrators in setting management objectives. These objectives will specify how much and what types of river recreation use is permissible without unacceptable change to the desired environmental, social, and physical settings. This cooperative research will define the research questions, isolate and prioritize components of the problem that are researchable; and, in partnership with resource administrators, conduct studies to answer the prioritized questions.

Determining the appropriate use of a large recreation environment is a complex process that requires many different inputs. Research can play an important role in providing some of the inputs, but its role is limited. Decisions about appropriate use may be as political as they are technical.

We assume that determining appropriate use can only be decided through a systematic planning process in which many inputs from the public and political sectors, as well as the research sector are considered. The process must involve the setting of specific objectives for management which can then be translated into managerial actions. Once objectives are determined, managers can identify indicators of performance and select strategies to meet those indicators. We have attempted to design a research strategy that focuses on

providing information which will help in the development of management objectives for recreational use of the study rivers.

Because the issue is complex, we have proposed a series of projects over several years. Certain information and understanding must be acquired before work on specific problems can proceed. Therefore, we see the research as moving from an initial step of generating additional background information, to a second step of defining the nature of the problems, and then to a third step of developing actual solutions to the most critical problems. We have identified a set of research topics that will provide the most useful background information. These topics will deal with the most important persons or groups involved in influencing management directions for the river (the managers, the users, the commercial sector, and inhabitants of the region, including interest groups and riparian landowners), the legal and administrative directives that guide actual decision-making, and the impacts of recreational uses on the environment being managed.

The research plan emphasizes the human component of the resource. While there are many concerns with the ecological impacts of recreational use, we believe that most of the issues raised with regard to management of the study rivers involve concerns over the human element, including use-related problems and conflict. Thus, a major part of our research effort is intended to identify the elements of the human community involved with the study rivers, and how those elements interact with respect to the rivers.

Through a process of reviewing past research and management information as well as brainstorming and numerous meetings with research administrators, researchers and other knowledgeable persons, we generated a comprehensive list of information needed and potential research topics. We then went through

numerous rounds of evaluation and prioritization. The projects described here represent our attempt to cover the range of potential topics while allowing for enough depth of analysis to be useful to management.

Proposed research has been grouped into four major subject areas. The thrusts of research are targeted toward those areas we believe are most important to understanding management of appropriate recreational use. They involve:

- 1) the environment and impacts resulting from recreation use,
- 2) the nature of the users and their recreational experiences,
- 3) the social and economic aspects of the region impacted by recreational use of the rivers, and
- 4) the management system that is involved to oversee and protect the resource.

Projects identified under the subject headings vary in starting and completion times. Because research in future phases depends on the outcome of these projects, we have not attempted to specify all possible research for the future phases.

Specific studies for each of the four research components are briefly described below.

Ecological Component

Proposed research would focus on five issues: (1) analyses of site impacts--characterize vegetation and soil related impacts occurring on recreation sites and the relations of such impacts to visitor types and use levels and environmental conditions, (2) monitor resource impacts--develop objective methods to monitor resource impacts on recreation sites over time, (3)

evaluate site management strategies--characterize recovery rates and rehabilitation effectiveness of sites closed to recreational use, (4) analysis of trespass--characterize the amount of trespass by river floaters on private land and the nature of resource impact caused by such activity, and (5) fish and wildlife impacts--characterize the types of fish and wildlife impacts potentially caused by river recreation activity.

User Behavior Component

The question of what constitutes an appropriate recreation experience is strictly a matter of personal taste. It is not a question science can answer. However, what research can do is document what experiences are desired from the perspective of the recreationist. It also can specify the conditions which are necessary for these experiences to be generated. Having identified the necessary conditions, research can then help evaluate the effectiveness of various management strategies in creating or maintaining them.

The research strategy of this component would be organized around three sequential goals: (1) specify appropriate recreation experiences which would be provided on the three study rivers through an improved understanding of the desired experiences of various clientele groups (recreationists, riparian landowners, etc.), (2) specify critical elements of the resource and social settings necessary to generate appropriate experiences, and (3) evaluate the effectiveness of alternate management strategies to generate appropriate experiences.

Socio-Economic Component

Proposed research would focus on five issues: (1) community analysis--identify the members of the communities, including riparian landowners, who have an interest in the management of the rivers and how

community members or groups relate to one another. Additional information will be sought concerning the relationships of community members to the river resource and the National Park Service as the sole or cooperating management agency, (2) analysis of outfitting and outfitters--identify the nature and extent of outfitter operations, outfitters' perceptions of Park Service management directions, and the potential for developing additional cooperative relationships with them to manage the river for the maximum possible benefit, (3) regional economic impact--examine the contribution to the local and regional economy of recreation use of the study rivers. Such information would serve to help evaluate potential impacts to the region of expanding or limiting recreation opportunities in these settings, (4) regional supply and demand--identify other river resources in the region and the types of opportunities provided compared to the study rivers, and project demand for future types of regional recreation opportunities, particularly those provided by the study rivers, and (5) economic efficiency of management decisions--determine the net economic benefits produced from the implementation of potential management strategies.

Managerial Component

Managers are basically one component of a broader social system in each of the river settings under study. The interactions of managers with others, their perceptions of problems, and the ways in which they define and implement solutions are not fixed, but tend to vary across situations, environments and managers. The current management issues are as diverse as are the proposals from various interested parties to influence that management. This underscores the need to understand management's role in the overall picture and to attempt to make it as effective as possible in dealing with the concerns of these varied and divergent interests.

Proposed research would focus on three issues: (1) legislative analysis--analyze the legislation and precedents to determine if there are indications in these sources to assist managers in adopting use-related objectives and techniques appropriate for these three rivers as well as to help guide specific research activities, (2) management system analysis--examine the current management processes on the three study rivers through in-depth interviews with managers to generate information concerning their strategies of management, problem definition, use of research, and communication with various publics, and (3) management technology--understand the ways in which managers use scientific information and translate it into managerial action as well as develop or apply technologies such as computer graphics to display the nature and consequences of potential management actions.

I. OVERVIEW

In 1984, the Mid-Atlantic Region of the National Park Service entered into a cooperative agreement with the U. S. Forest Service's North Central Forest Experiment Station River Recreation Management Research Unit to investigate river recreation use and carrying capacity on three areas under their administration--the Upper Delaware Scenic and Recreational River, the Delaware Water Gap National Recreation Area, and the New River Gorge National River. This research is necessary, in part, because of the rapidly growing recreational use occurring in these areas during the past decade and the subsequent concern of the Park Service to insure these river areas are appropriately managed to provide for and to protect the recreational, natural, and cultural resources and values for which they were established. It also is necessary because growing recreational use is resulting in increased impacts to the broad community of the river environments such as riparian landowners, commercial entrepreneurs, local governments, area residents, and other citizen groups.

Special funding was obtained by the Mid-Atlantic Region to implement a three-year research program to examine the concerns of Park Service management, recreational users, and public and private interests. The anticipated level and probable duration of funding and the regional perspective of the study areas allows for the design of a comprehensive, indepth research program to aid resource administrators in setting management objectives that specify how much and what types of river recreation use is permissible without unacceptable change to the desired environmental, social, and physical settings.

At the initiation of this research, resource administrators expressed a variety of possible research questions: How can ecological and environmental

changes associated with river use be monitored and evaluated over time? How can site deterioration caused by recreational use be predicted? How can perceived crowding associated with user satisfaction be addressed? What conflicts exist between boaters and anglers, boaters and riparian landowners, commercial and private users, local and non-local residents, experienced and inexperienced users, and different size groups of boaters? What facilities are needed at access and egress points, campsites, and popular stopping points? What safety programs and procedures are needed for boaters and other river users? What management techniques and controls will work best to achieve desired management objectives established for these river stretches?

The focus of this cooperative research venture and this research plan is to define the research questions, isolate and prioritize components of the problem that are researchable, and in partnership with resource administrators initiate studies to answer the prioritized questions.

Strategy of Research

Determining the appropriate use of a large recreation environment is an extremely complex process requiring many different types of inputs. We believe research can play an important role in providing some of those inputs. It is necessary, however, to recognize both the limits of and the appropriate roles for research.

Determination of and management for appropriate use is part of an on-going recreation resource management process. We have designed our approach to the problem to fit into that process. Efforts to make decisions about appropriate use involve social consequences and may be as political as they are rational, technical decisions.

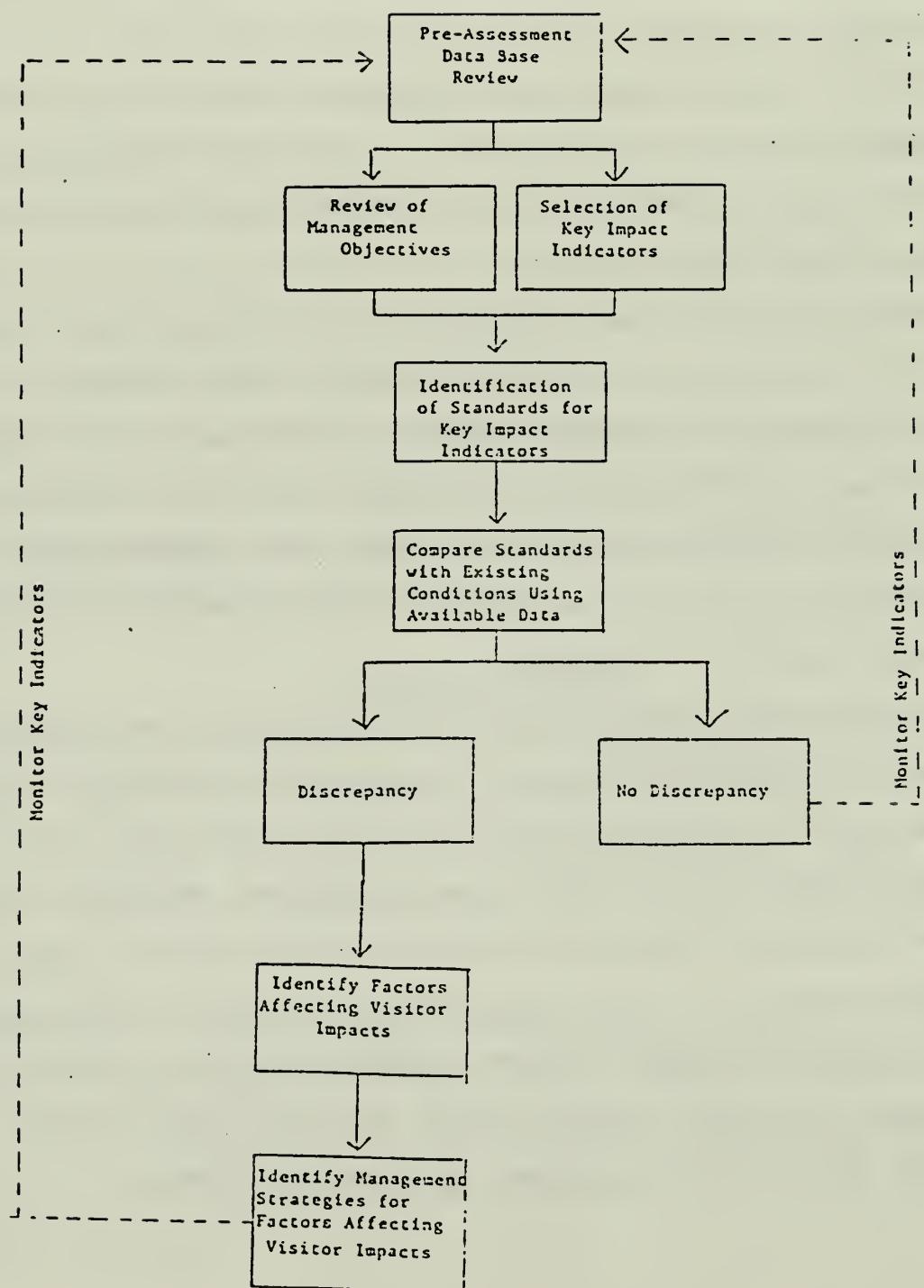
A fundamental assumption of our involvement with the National Park Service in this research is that such issues can only be decided through a systematic planning process in which many inputs from the public and political sectors, as well as research information, are considered. The process must involve the determination of specific objectives for management which can then be translated into managerial actions. Once objectives are determined, then management becomes a process of identifying indicators of performance and the selection of strategies to meet those indicators.

A variety of planning models have been adapted to implement decisions about maintaining appropriate recreational use. Figure 1 shows a strategy for pursuing visitor impact management in National Parks (Graefe et al. 1983); Figure 2 shows a planning process for determining the Limits of Acceptable Change (LAC) in wilderness (Stankey et al. 1985). Both represent sequences of use monitoring and evaluation, and both start with the determination of the appropriate objectives for management.

In reviewing past approaches to determining appropriate use, we have found that one of the greatest difficulties in using research information is that there are few or no objectives specific enough upon which to base decisions about the management and/or control of recreational use. Objectives may be taken as a given, as in the case of wilderness, but even there we can see room for interpretation, as in Step 2 of the LAC model (Figure 2), "define and describe opportunity classes." We have attempted to design a research strategy that focuses on providing information which will help in the development of management objectives for recreational use of the study rivers.

Figure 1

Basic Elements of Visitor Impact Management



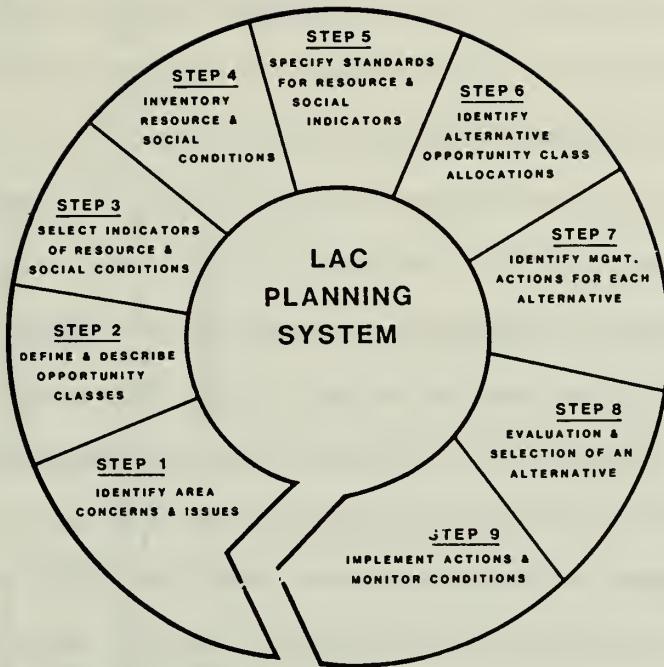


Figure 2. The Limits of Acceptable Change (LAC) planning system

While it is impossible to dictate the specific nature of the planning process, we believe that a comprehensive generation of data will be of limited use unless incorporated in a systematic management planning effort. Further, it is our assessment that the problems experienced from recreational use of the rivers are complex problems that require a variety of inputs. Any one of the studies described herein, if done in isolation, would be an incomplete part of the picture, and potentially useful results would become little more than a Band-Aid for specific symptoms of the problem.

In recognition of the complex nature of the situation, we have designed a strategy that involves a series of efforts over several years. Certain types of information and understanding must be generated before work on specific problems can proceed. Therefore, we see the focus of research as moving from an initial step of generating additional background information, to a second step of defining the nature of the problems, to a third step of developing actual solutions to the most critical problems. Figure 3 represents our view of research inputs into the management process. We have identified a set of research topics which can provide the most useful background information for understanding the nature of the problems facing management of the resource. These have to do with the most important persons or groups involved in influencing management directions for the river, the legal and administrative directives that guide actual decision-making, and the impacts of recreational uses on the environment being managed.

The initial focus is the broadest, and studies initiated the first year may appear to have the least practical application. However, a fundamental understanding of the various elements of the system is necessary before problem-solving can proceed. We think it important to generate more specific information about the persons affected by management of the rivers, on use of the river, on the environment, and on the legislative background of area designation. As mentioned above, we want to look at those persons most likely to play a role in the future use and management of the rivers: the managers, the users, the commercial sector, and inhabitants of the region, including interest groups and riparian landowners. We also want to establish baseline information on the impacts of recreational use on the environment.

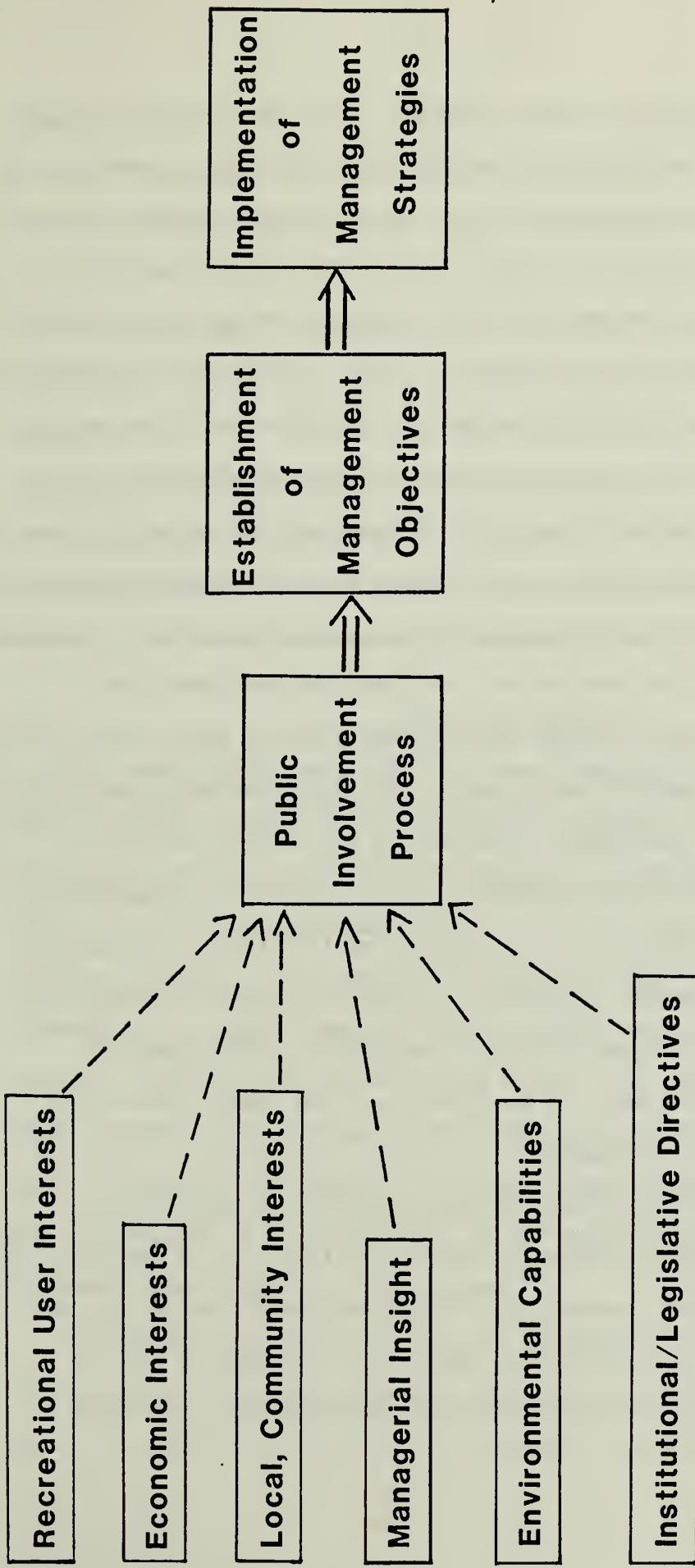


Figure 3. The process of implementing management strategies

The focus of research in the second stage will shift toward identifying the nature of problems perceived by the various groups. This phase is not separate from the first one, but is an extension of it, which is why a number of research projects described are intended to do both. Things which may be seen as a problem by one group may not be seen as such by another, or may even be defined differently by other members of the community. Thus, the views of the different members and their perceived conflicts and desired solutions are to be examined.

The focus of research in the third phase moves into the objective setting process through the examination of potential alternatives for action and ways to solve the various perceived problems. Here the role of the researcher begins to change, moving from information generator to consultant on the actual process of objective setting and conflict resolution. This may include inputs on negotiation techniques, more effective ways to obtain public input, how to write objectives, what types of objectives to write, and ways of weighing the costs and benefits of different management strategies to the various interests.

Future roles for research are dependent on the direction of management and needs for information. A major role for research would likely be to evaluate the effectiveness of management strategies in attaining identified objectives. Once objectives are set, it is possible for researchers to help identify standards of performance and means of monitoring use and impacts which will serve as feedback on that performance.

While the research described here has been described in terms of its application to the management problems of the study rivers, it is important to note that we have approached the analysis of the question of appropriate use from as broad a perspective as possible. Our purpose has been to provide information that not only will be applicable to the problems on the study

rivers, but useful to a wider audience as well. We want to pursue research which will generate methodologies and findings which can guide similar problem-solving efforts in other river and recreation resource management situations.

Further, we want to be able to contribute to the overall scientific knowledge in the field of research on questions of the determination of appropriate use. In this way, we hope the investment on research to solve problems on the study rivers can yield returns in a much broader arena. To the extent that this research plan is successful, it is possible for the study rivers to serve as examples of the successful application of principles for the determination of appropriate use in managing recreation resources.

Focus of Research

Our research plan emphasizes the human component of the resource. While there are many concerns with the ecological impacts of recreational use, we feel that most of the issues raised with regard to management of the study rivers involve concerns over the human element, including use-related problems and conflict. Thus, a major part of our research effort is intended to identify the elements of the human community involved with the study rivers, and how those elements interact with respect to the rivers. All actions taken by administrators, and all uses of the river occur in the context of social groups and institutions, and interact with those groups' values, beliefs and goals. Any action taken by an individual, group, organization or agency is thus likely to impact other elements in the system.

Problem-solving implies taking actions which will affect other elements of the system to bring about change. Ability to do so may be contingent upon the perceived need for change and the likelihood that other elements in the system

(groups, organizations, political bodies) will in fact accept the change. Both the assessment of need and implementation of change are contingent upon understanding the overall system. A problem perceived by one element of the system (e.g. agency administrators) may not be so perceived by other elements. Further, an action assumed to be "for the better" for the overall system may exact different costs or provide different benefits to the various elements of the system.

Sensitive planning and management will of course account for these concerns. However, to assess the tradeoffs in benefits and costs effectively, a clearer understanding of the groups involved and their particular views and situations is necessary. This has been a major consideration in our selection of research topics, and in the proportional allocation of research effort and dollars.

II. RESEARCH PROJECTS

Research Priorities

It would be virtually impossible to generate all the information which would be useful in such a process. We have had to make decisions concerning the most effective use of research dollars in generating information. Through a process of reviewing past research and management information as well as brainstorming and numerous meetings with research administrators, researchers and other knowledgeable persons, we generated a comprehensive list of information needed and potential research topics. We then went through numerous rounds of evaluation and prioritization. The projects described here represent our attempt to cover the range of potential topics while allowing for enough depth of analysis to be useful to management.

Proposed research has been grouped into major subject areas. Four major thrusts of research are targeted toward those areas we believe are most

important to understanding management of appropriate recreational use. They involve: 1) the environment and impacts resulting from recreation use, 2) the nature of the users and their recreational experiences, 3) the social and economic aspects of the region impacted by recreational use of the rivers, and 4) the management system that is involved to oversee and protect the resource. We have also included an additional category to include projects that do not logically fall under one of the four designations.

Projects listed under the subject headings vary in when various activities will be initiated and the amount of time needed to complete the research tasks. As research in future phases will depend somewhat on the outcomes of these projects, we have not attempted to specify all possible research for the future phases.

We have designed a research plan we believe is adequate to address the questions involved while attending to the realities of fiscal limitations. In recognition of possible fiscal constraints, we have attempted to prioritize our research projects into those that we believe are most central to our effort and those which we believe are needed, but which must be assigned a lesser priority. Further, we are aware that funding for future years in any project is uncertain. However, in our attempt to design a comprehensive and integrated plan of research, we have viewed current base levels of funding to be an initial investment in the attempt to deal with very complex and difficult problems. To the extent that future funding is forthcoming, a reorganization of the research effort may be necessary. We hope this plan will allow for direction in terms of estimating how much money will be needed in the future and will provide a basis upon which to justify further expenditures.

Ecological Component

General Strategy

In most river recreation settings, visitor use is concentrated at a relatively few locations such as at overnight and day use sites, and access sites. The nature and extent of resource damage or change at these sites is a function of their durability and resiliency as well as the amount and nature of the recreational use the site receives.

Growing recreational use within the river corridors at the three study rivers (both on public and private land) and the mandate of resource administrators to limit environmental change to an "acceptable level" necessitates the need to better understand the environmental impacts of recreational use occurring and to improve information gathering techniques to effectively monitor change over time. Proposed research would focus on 5 issues: (1) characterizing vegetation and soil related impacts occurring on recreation sites and the relations of such impacts to visitor types and use levels and environmental conditions, (2) developing objective methods to monitor resource impacts on recreation sites over time, (3) characterizing the amount of trespass by river floaters on private land and the nature of resource impact caused by such activities, (4) characterizing recovery rates and rehabilitation effectiveness of sites closed to recreational use, and (5) characterizing the types of fish and wildlife impacts potentially caused by recreation activity.

Such information will aid planning and management activities by identifying what types of impacts occur, where, their severity, and how conditions change over time. Through this research it will be shown how impacts vary under different use intensities and under differing site conditions. This information

will help guide decisions such as where to locate new sites, which ones to close, and the appropriateness of concentrating use on a few designated sites or rotating use by dispersing recreationists over a large number of sites.

There is considerable research experience in studying environmental impacts of recreational use, particularly in the west, but few studies have identified resource impacts occurring on rivers in general or on the three rivers under investigation. As a result, this research activity will progress in two phases. The first phase, beginning now and lasting about one year, will focus on identifying components of the problem and selecting study sites and specific variables for investigation. The second phase will consist of several field studies designed to assess the type and extent of environmental impacts occurring and the factors which influence them.

Plan of Research

Evaluation of resource impacts on recreation sites. This research would investigate the types, location, and severity of vegetation and soil related impacts occurring on campsites and day-use sites along each of the three river segments. Particular attention would be given to such impacts as vegetation trampling, loss of ground cover and soil exposure, tree damage and root exposure, loss of tree regeneration, soil erosion and compaction, human waste, and litter. Through this research relations would be characterized between impacts and both amounts and types of recreation use and environmental conditions such as soil, vegetation, and landform types.

Reconnaissance activities in 1985 would facilitate specifying problem components and study variables as well as selecting specific sites for in-depth study in 1986. Ten to twenty sites are projected for investigation on each study river. In addition, if feasible, approximately five new campsites will be

developed and opened for use in 1986 at the Delaware Water Gap to assess initial impact rates.

Specific research objectives are:

1. To characterize types, location, and severity of resource impacts on recreation sites.
2. To characterize relations between resource impacts and amounts and types of recreation use and environmental conditions.
3. To suggest potential strategies and criteria for management decisions concerning the durability of various sites to sustain recreational use.

A study involving experimental trampling of vegetation plots will also be conducted to complement the impact study described above. Experimental trampling in one or more environmental settings can provide the most accurate information concerning the relations between resource impacts and use intensity, vegetation types, and land types. Reconnaissance work for the trampling experiments would be completed in 1985 at the Delaware Water Gap as part of the reconnaissance activities for the impact study. The indepth study would begin in 1986 along with the impact study.

Resource impact monitoring and assessment systems. Such systems offer resource managers an objective, standardized approach for collecting, summarizing, and evaluating information on recreational impacts. These management-oriented systems provide site specific information concerning the nature and severity of resource impacts. When periodically reapplied as part of an impact monitoring program, these systems can provide a consistent record of conditions over time. This allows managers to detect and evaluate deteriorating or improving conditions on individual or group sites, evaluate the success or

failure of resource protection measures, and set and monitor limits of acceptable change for resource conditions.

Research for the development of an impact monitoring and assessment system was conducted in 1984 as part of this carrying capacity study by the Forest Service in cooperation with managers of the Delaware Water Gap. It is proposed in this study to: (1) refine and apply the developed system on the New River in 1985, with analysis continuing into 1986, and (2) explore the potential of microcomputer software to aid managers in using impact monitoring systems and development of such software if appropriate.

This research will benefit from the studies outlined above to investigate indepth the nature of resource impacts on recreation sites. Products from that research might uncover additionally relevant impact indicator variables that later could be incorporated into the monitoring system currently being employed.

Specific research objectives are:

1. To implement and evaluate an impact monitoring system that managers could periodically apply to access changing resource impacts at specified recreation sites.
2. To develop microcomputer software to aid managers in monitoring and evaluating resource change on recreation sites.

Impacts from trespass on private land. Trespass of river floaters, anglers, and other visitors to river corridors is an increasingly serious concern on many eastern rivers and is perceived as a particularly troublesome river management problem by resource managers, riparian landowners, and business operators on the Upper Delaware River. A reconnaissance study is proposed in 1985 to document the amount and nature of trespass on private land and, if appropriate, lay the groundwork for further research on the problem.

The 1985 study would inventory campsite and day-use sites along the river corridor that are visible from the water, or possibly from the air. With permission from riparian landowners, sites would be visited briefly to classify the apparent type and amount of use each site receives as well as to roughly assess the amount and nature of resource impact. A modification of the resource impact assessment monitoring system developed for use on the Delaware Water Gap and New River is proposed for use in this study. If the 1985 reconnaissance suggests further inquiry, further modification of the monitoring system might be necessary as well as other information gathering activities.

Specific research objectives are:

1. To characterize the type, location, and extent of visitor trespass on private property along the Upper Delaware River corridor.
2. To develop a resource impact monitoring system for managers and/or others to assess resource change on trespass sites over time.
3. To suggest further research, if necessary, to address the trespass problem.

Site recovery and rehabilitation studies. How rapidly do sites recover after use is curtailed? Knowing this would aid managers in evaluating the appropriateness of dispersal and/or rest-rotation strategies and might help assess alternative techniques to rehabilitate impacted sites. The feasibility of this research rests with the Park Service's willingness and ability to close (and keep closed) a limited number of sites.

Reconnaissance work in 1985 at the Delaware Water Gap would be combined with that needed for the impact study outlined above with little additional cost. If feasible, approximately five campsites would be identified for closure in 1986. Recovery rates would be assessed yearly for the first three years and on alternative years thereafter pending availability of funding or personnel.

Evaluation of recreational impacts on fish and wildlife. There is a basic lack of understanding of the types of fish and wildlife impacts caused by recreation activity--not only for the three study environments but in general. To what degree are particular species harassed and/or displaced because of excessive recreational use at certain times or locations? Are there particularly sensitive feeding or nesting areas along these rivers? Are there rare and/or endangered fish and wildlife species that are especially sensitive to recreational use? How can management respond to such impacts if they occur?

Preliminary research would focus on a systematic review of current knowledge about such impacts through consultation with managers, scientists familiar with the rivers and recreational impacts on fish and wildlife, and other knowledgeable individuals. This task could start in 1985, and would seek to synthesize available information about critical species of fish and wildlife, their numbers, distributions, and habitats as well as to offer an evaluation about the possible severity of current impacts resulting from river recreation activities both on the water and on shore. From this brief but careful analysis, suggestions would be offered for a more indepth program of research to address critical problems.

User Behavior Component

General Strategy

Change is the natural, inevitable consequence of increasing recreational use of an area. Some aspects of change are almost universally welcomed such as the expanding availability of interpretive services that tends to accompany increasing use. Other aspects of change we find undesirable such as the increasing presence of litter or vegetation damage. But for many aspects of change, the consequences are not so straightforward. It depends upon whom we

ask. The construction of a riverside picnic area may be welcomed by some as an enhancement to their experience, but may be opposed by others as a totally unwarranted intrusion upon the natural landscape. The presence of an increasing number of other users may yield a comforting sense of security to some, yet for others it may represent a distasteful disruption of a solitude experience.

In face of the inevitable forces for change, and in face of the potential for change to favor certain interests over others, it seems that the fundamental role of a resource manager is to specify the kinds of conditions that will be permitted to occur in an area. Such conditions deal both with the state of the resource and the character of the recreation experience. The user behavior component will focus upon the general problem of defining and providing for appropriate experiences on the three study rivers.

The question of what constitutes an appropriate recreation experience is strictly a matter of personal taste. It is not a question science can answer. However, what research can do is document what experiences are desired from the perspective of the recreationist. It also can specify the conditions which are necessary for these experiences to be generated. Having identified the necessary conditions, research can then help evaluate the effectiveness of various management strategies in creating or maintaining them.

Unfortunately, after more than a decade of social research in outdoor recreation management, it seems that researchers and managers alike are perplexed by the complexity of the problem of defining the character of experience. We remain frustrated by our relative inability to quantify such concepts as need diversity, substitutability, displacement, conflict, crowding, and other fundamental concepts of recreation management. We remain befuddled by our relative lack of ability to empirically account for perceptual and attitudinal differences among users, even when it is intuitively clear that such

differences exist. Rather than being paralyzed by these inadequacies by following a logical extension of past research, it is proposed that the research strategy approach the assigned problem with a thrust toward conceptual and methodological innovation. In brief, researchers would be charged to look beyond the traditional expectancy-value motivational models and survey research. There will be a multidisciplinary review of alternate and successful methods employed in other fields of inquiry.

The research strategy of this component would be organized around three sequential goals:

1. To specify appropriate recreation experiences which would be provided on the three study rivers. The specification will be accomplished from consideration of both existing and potential (latent) demands for the resources --reflecting the interests of both on- and off-site clientele, and both traditional and nontraditional uses. The research will be framed around the goal of developing experience based river management objectives. Expressed desired experiences of various clientele groups (recreationists, riparian landowners, etc.) will be analyzed and specified, but the research also will evaluate the potential role of the study environments in serving latent or unexpressed needs. The potential role of the commercial outfitting industry in serving and profiting from knowledge of expressed and latent demand will be analyzed.

2. To specify the conditions necessary to generate appropriate experiences. At this level research is directed toward specifying critical elements of the resource and social settings that need to be present. A significant task is to identify a limited set of indicators which adequately serve as measures of the overall performance of the resource in delivering the specified experiences.

The research also will be directed toward defining standards for each indicator which describe the range of acceptability in the context of delivering the specified experiences.

3. To evaluate the effectiveness of alternate management strategies to generate appropriate experiences. The content and character of research at this level will be formulated towards the completion of study on the first two goals. Here the focus is upon evaluating the effectiveness of alternative strategies to maintain standards within acceptable bounds. Research will focus on evaluating appropriate actions for those standards deemed most difficult to maintain. The research generally will emphasize experimental design methodology (control and treatment groups) with comparisons made in the context of numerous performance criteria such as cost, administrative effort, degree of public support, and impact on perceived freedom of the visitor.

Plan of Research

The identification of specific studies or conceptual issues is not feasible now because a framework is first needed to guide the conduct of this research component. As a result research will unfold in a three-fold sequence.

Initiation of research on experiences of clientele groups. Stage 1 calls for the formation of a working group to: (a) conceptualize the scope and dimensions of the assigned problem, (b) generate innovative theoretical and managerial frameworks capable of guiding a program of research beneficial both to scientific and managerial problem solving, and (c) formulate the specifics of a two-year program of research designed to address research goals 1 and 2 above. This work will be completed by January 1, 1986. Some activities during this period include (1) conduct a workshop or workshops to pursue its objectives, (2) visit the study sites to gain first hand knowledge about their recreational use

and to build management and public input into the formation of study objectives, (3) consult with selected scientists specializing in the character of human experience, (4) conduct extensive literature searches, and (5) conduct pilot on-site studies of river recreationists or other clientele groups during the summer field season to evaluate promising ideas.

Definition and specification of clientele group experiences. Stage 2 calls for the implementation of the two-year (or longer) research plan developed in Stage 1. It will feature intensive field research during the summer use seasons of 1986 and 1987. The process will be oriented to the definition of appropriate experiences, the expression thereof in terms of specific river management objectives, and the specification of standards for attaining these objectives. Critical resource factors (vegetation and soil impact variables, water quality variables, for example) and social factors (use density and human waste variables, for example) related to the attainment of appropriate experiences will be identified and standards created. The process will recognize, and account for, diversity among population sub-groups. The emphasis will be upon defining these issues from the user's perspective and upon working with managers to interpret such information in the context of other inputs which go into the definition of river management objectives.

Evaluation of management strategies. Stage 3 calls for the implementation of a limited number of studies to evaluate the relative effectiveness of a range of management actions in helping to achieve objectives developed under Stage 2. While specific issues and studies cannot be identified until completion of Stage 2 research, it is likely that problem areas already broadly perceived by managers and the public will be under analysis (for example, litter, crowding, human waste management, vegetation impact, trespass, information management). The goal is to determine the most efficient action plan for ameliorating such

problems to within acceptable standards. We anticipate about 5 separate studies over a two year period to deal with the 5 most critical issues.

Socio-Economic Component

General Strategy

The focus of this component of research is intended to follow the general strategy of research in first seeking to generate basic data on the make-up of the system, then analyze the definitions of problems perceived by the various parties involved, and then seek specific solutions to the problems. First, the various elements in the social system and the ways they are interrelated will be identified. The social system is considered to be composed of any people who will be impacted by actions taken by administrators of the study rivers and the groups, organizations and/or communities to which they belong. Then we wish to focus on the perceptions by these various groups of the study rivers, particularly with respect to values derived and problems perceived. This would include their perceptions of other factors affecting the system. The third phase of research would focus on solutions to perceived problems, the barriers or opportunities for their implementation (including strategies to increase successful adoption of changes), and means of assessing benefits and costs to the different components of the system.

Plan of Research

Community analysis. A fundamental aspect of this research is to identify the members of the communities, including riparian landowners, who have an interest in the management of the rivers and how they relate to one another. Additionally, information will be sought concerning the relationships of community members to the river resource and the National Park Service as a

management agency. This information would allow for the assessment of management objectives with respect to the provision of the greatest possible benefits to the public and help identify potential problems associated with management objectives. It also would suggest the most useful ways to include public input into the management planning process, and the most effective ways to communicate management decisions and actions to the public. This is intended to facilitate the development of acceptable management plans and activities.

Research would first focus on defining who are the particular community members that have a stake in river management. This would seek to identify key persons in a community who would have input into resource management decisions. Once this knowledge is gained, it would be possible to identify the key issues as perceived by various community members or groups. The 1984 attitude survey on perceived problems conducted by the Foresight Consulting Group (1984) on the Upper Delaware River represents one element of this type of approach. Ideally, this component would build on and expand these types of efforts to allow for subsequent research to develop workable techniques for dealing with the public in ways which will be fair as well as allowing for successful management of the study rivers.

Objectives of this component of research:

1. To identify the socio-cultural context in which the study rivers exist.
2. To identify the relevant community of individuals or groups affected by and influencing the administration of the study rivers.
3. To identify networks of communication and patterns of interaction among the relevant individuals or groups.
4. To identify relationships and factors influencing the introduction of change among the relevant social groups.

5. To develop and evaluate a research strategy for such community analyses which may be generalized to similar research situations.

6. To analyze the bases for possible conflict among the various segments of the public and identify the most effective means for resolving those conflicts through managerial actions, including involvement and negotiation.

Outfitter study. The outfitters are an important part of the overall social community to be studied because of their direct relationship with resource management and their important potential role as cooperators in the management process. They can play a key role in affecting visitor behavior to reduce the problems perceived by other members of the system. Further, they have a direct economic interest in decisions concerning recreational use of the rivers. As a result, we propose specific research which would point toward identifying the nature and extent of outfitter operations, outfitters' perceptions of Park Service management directions and the potential for developing additional cooperative relationships with them to manage the river for the maximum possible benefit.

Objectives for this component of research are:

1. To characterize the operations of river outfitters on the study rivers, the nature and extent of their activities and the economics of their operations.

2. To identify outfitter perceptions of river management and their desires for future management directions.

3. To identify the most useful ways their views can be accommodated in the management planning process.

4. To explore opportunities to collaborate with management to pursue mutually shared objectives.

5. To assess the potential influence on visitor behavior through the dissemination of information by outfitters.

Regional economic impact. The provision of recreational opportunities on the study rivers provides economic benefits to the surrounding communities. Some persons may benefit more than others in this regard. The provision of employment opportunities through development of recreational use may be significant. This study would examine the contribution to the local and regional economy of recreational use of the study rivers. Such an analysis would be intended to provide further information concerning the potential impacts to the region of expanding or limiting recreational opportunities on the study rivers. This would help in the search for solutions which would provide the best combination of benefits to the public.

Regional supply and demand. The study rivers do not exist in a vacuum. Rather, they are a part of a larger recreational complex, both in terms of water-based recreation as well as other types. Thus, decisions made about the appropriate use of the rivers may be affected by the role they may play in this larger picture. That is, potential experiences provided on the rivers must be evaluated in terms of their relative abundance or scarcity in the region. Further, the current use of the rivers must be couched in assessments of potential future demand for those as well as other types of opportunities. This study would look at the regional recreation picture in terms of supply and demand. It would specifically focus on river recreation, identifying other river resources in the region, and the types of opportunities provided compared to the study rivers. It would also view the demand for river recreation opportunities. This would be evaluated in the broader picture of demand for recreation in the region. It would attempt to project demand for future types of recreational opportunities, particularly those provided by the study rivers. A large part of this research could be drawn from existing analyses such as in

statewide comprehensive outdoor recreation plans; but, we also will seek to improve the sophistication of such approaches by seeking new and innovative techniques to determining supply and demand.

Economic efficiency analysis. The study described above is intended to provide information concerning the economic contributions of recreational use of the study rivers. Any managerial decision affecting use will provide some economic costs and benefits. A useful input to management decision making would be the ability to assess the aggregate impact of potential decisions. Some decisions may cost more than they benefit. One criterion for the assessment of construction of federal projects is a benefit/cost analysis. Such analyses are usually pointed toward specific project expenditures. A project is considered efficient if the benefits produced outweigh the costs.

Similar principles can be applied to the more general impacts produced by a management action. In other words, it would be desirable to determine how much wealth is produced by a given management practice. Further, since the benefits and the costs go to different sectors, the analysis must be placed in a sufficiently broad context, by determining if the region as a whole is more wealthy as a result of the management action.

This project would be designed to determine the net benefits produced from the implementation of potential management strategies. While methodologies for studying regional economic impact are reasonably well developed, those for measuring economic efficiency are still in an evolutionary stage. This is due to the difficulty in determining the nature of net benefits for something as diffuse as a management strategy. In this sense, the project would be pointed toward the development and refinement of such methodologies and would have broader applicability than to the three study rivers.

Managerial Component

General Strategy

Persons charged with administering recreation resources tend to be viewed primarily as being responsible for confronting and dealing with the problems of their clients, rather than being the focus of study themselves. However, as we have discussed previously, managers are basically one component of a broader social system in each of the river settings under study. The interactions of managers with others, their perceptions of problems, and the ways in which they define and implement solutions are not fixed, but tend to vary across situations, environments and managers.

Managerial actions could conceivably hinder the solutions to problems, rather than advance them. Thus, it is necessary to understand the process of management itself, the institutional context in which that management occurs and how the actions of management may work to facilitate or hinder solutions to problems perceived by other members of the social system.

There are many controversies surrounding the study rivers, and the managers sometimes appear to be at the heart of them. It is generally agreed that the three river environments are highly valuable. The controversies over their use and management serve as indirect but powerful evidence of their value.

The current management issues are as diverse as are the proposals from various interested parties to influence that management. This underscores the need to understand management's role in the overall picture and to attempt to make it as effective as possible in dealing with the concerns of these varied and divergent interests.

There are three areas of concern upon which we want to focus. First, we need to understand the nature of managerial interaction with the public, and the

extent to which communication patterns promote effective flow of information about managerial actions in both directions. Second, we want to define the nature and extent of constraints that limit managerial options for coming up with solutions. For example, such limitations may come from the legislative and policy bounds which define the directions of managerial effort. They may also result from the tendency of managers to define problems and potential solutions from a distinctive and fixed perspective, as the result of professional background and organizational ideology.

Finally, we want to understand the ways in which management uses scientific information and translates it into managerial action. Research generates information that is useful to managers in evaluating the nature and extent of problems to be dealt with. However, that does not guarantee that the most successful solutions will be found, or that there will be ways to incorporate this information into management. Thus, we are concerned about the ways in which we can make the information work in the system.

The issue of communication is one that cannot be underestimated, particularly given current public values concerning the responsiveness of federal resource managing agencies. A central question in resource management is whether managers are sufficiently aware of their clients' views to assure the provision of maximum possible benefits to people. A social system is comprised of many individuals and groups, each with their own sets of values and beliefs. Social systems are effective when each person is aware of and understands and respects the values and beliefs of all of the other persons. Conversely, social systems are not effective when there is confusion and misunderstanding about others' values and beliefs. The ability to understand why others are making certain demands is critical to effective management.

Further, the acceptance of managerial actions is contingent upon the respect by other members of the system for the managers' actions and their reasons for undertaking them. This is important to the principle of public involvement; it also has the practical outcome of facilitating the ability of management to implement actions and policies.

We have gathered information from managers, researchers, public groups, and others about the Upper Delaware, Delaware Water Gap and New River environments. It is clear from our discussions that there is not common agreement on how these rivers should be managed. The lack of clarity about management is due to many factors, not the least of which are misunderstandings about the intent of managers. Such concerns are increased by the recognition that the management situation may represent a new role in an organization with an established management style (for example, Park Service managers at the Upper Delaware River are being asked to cooperatively manage a resource they will not own, and that is not the norm). These concerns suggest a need for understanding the ways in which information is transmitted both to and from the managing agency, and the role of that information in defining and solving the problems perceived by management.

The second issue focuses on legislative and policy constraints that limit or direct managerial attempts to find solutions to problems. Different managers within the same organization can perceive the range of options they have for dealing with a certain issue very differently. This is partly due to the processes by which general policies are formed. Such processes are imperfect in large part because of the considerable number of institutional entities involved--federal agencies, OMB, congressional committees, and numerous interest groups. The management strategy adopted by an administrator is consumed in the

manager's understanding of the inputs in the policy process. It is reasonable to assume each manager will understand and interpret policy in a different way. Research on the ways in which managers choose solutions is important if we are to understand past choices and project what future decisions are likely to be.

The leeway existing in current legislation is only one dimension of the situation. The views of the managers themselves may play a key role in interpreting policies, in defining problems and in identifying solutions. The three river environments are "controlled" by a diverse set of people, having different goals, values, beliefs, etc. Much of this results from different professional backgrounds, and different experiences in career development. Many of these values are shared beliefs which are a part of agency ideology, while others are personal factors. Thus, it is necessary to understand more clearly how persons with different values and beliefs may interpret information differently, and how they may seek different types of solutions. At one level, this may be seen as a constraint on the range of options available for dealing with problems. This research could explore ways in which such information could be used to expand the options available for solving problems.

The final area of emphasis is in the actual adoption of research information. There is no guarantee that information generated by scientists will actually be used in resource management. This is due to the delivery of the information, as well as the capacity of the management system to incorporate information into actual problem-solving behavior. We have emphasized our strategy to provide information to be input into the writing of objectives. That means there must be some ability to incorporate information into a management planning process. We recognize such abilities are not always present; thus, there may be some need to incorporate skills on designing

effective objectives into the research design. In this sense, the role of research would be to improve the technology of management. We might look at and evaluate methods such as Limits of Acceptable Change (LAC) to see how well they facilitate goal formulation. We might also want to explore methods for visually displaying goals and evaluating their success (for example, computer graphics).

Plan of Research

Legislative analysis. Many of the reasons for managerial action and resulting controversy have to do with the legal and political directives under which administrators must function. The National Park Service is the federal agency with primary responsibility for establishing river management directives for the three study rivers. The broad management goal is that of protecting and preserving the resource and providing for appropriate recreational use of the resource by the public.

However, specific management objectives related to assessing appropriate use and management techniques employed have yet to be determined. Establishing these use-related management objectives and techniques is a process which involves the input of numerous resource management agencies, commercial operators, local residents, and river users. Another source of direction is the enabling legislation which designated these three sites, as well as legal and administrative precedents established for other similar resources and/or situations. This study will analyze the legislation and precedents to determine if there are indications in these sources to assist managers in adopting use-related objectives and techniques appropriate for these three rivers. Such information may also help guide specific research activities.

The research proposed for the initial phase is the development of a plan of study for a more in-depth analysis. This phase will include an identification

of crucial issues. It will also identify the source of information available to address those issues (for example, legislation, records of Congressional hearings, experience of managers, research literature, legal precedents, administrative plans and policies).

The objectives for this component of study are:

1. To identify legal and legislative directives which may give appropriate use directions to river planners and managers.
2. To identify crucial issues relating to setting and managing for appropriate use of the resources (for example, resource damage, intended visitor experiences, use of private land).
3. To develop a plan of study for more in depth analysis of the legislative and legal foundations for establishing appropriate river use guidelines for the New River Gorge, Upper Delaware, and Delaware Water Gap.

Management system analysis. The purpose of research in this area would be to examine the current management processes on the three study rivers. This would involve in-depth interviews with managers to generate information concerning their strategies of management, problem definition, use of research, and communication with various publics. Such information would be analyzed with the intent of identifying more effective strategies for taking action on problems in implementing use management on the rivers. Research may also include studies of managers in other recreation resource situations in order to allow for a base of comparison in defining and dealing with similar recreation resource problems.

Objectives for this research project are:

1. To define the relevant components of the management system, including members, clients, range and limits of control, and legislative and policy constraints.

2. To characterize the views of managers, including their basic values and beliefs about the process or resource management, and how those values and beliefs influence their definitions of the problems at hand and the solutions chosen to deal with those problems.

3. To analyze the communication flow between managers and their clients to evaluate its effectiveness in the problem-solving process.

4. To identify ways to introduce more effective management strategies into the problem solving effort.

5. To examine how research concepts get implemented or fail to get implemented in management and to identify ways to facilitate the use of such knowledge in problem solving.

Management Technology. This research would most likely take place in the latter stages of the research effort, and cannot be described with a high degree of specificity. It is intended to adapt state-of-the-knowledge technologies such as computer graphics to display the nature and consequences of potential management actions. In complex management situations, there may be many possible options for taking action on a variety of identified problems. The summary of research provided in the following section gives some idea of the potential complexity of courses of action. Thus, it would help to be able to view the various options and their predicted outcomes in a more understandable manner.

This would be particularly useful in the public input process because it would allow for greater understanding on the part of the public on the various potential courses of action. This component would have to evolve in collaboration with administrators to determine the most useful application of such technologies.

III. RESEARCH SUMMARY

This section provides a summary of the overall proposal for research described in this report. Table 1 lists the projects proposed by general area and by year. For each year, we have divided projects into those which we give the first priority and those that we judge to be slightly secondary in importance. By making such a prioritization, we do not wish to imply that second level projects are not significant, but rather that we have to make decisions about which information is most critical to problem solving. The projects are broken down by year, although we recognize that projects for later years are strongly contingent upon initial research efforts and cannot be totally specified at this time. Projects shown in this table are described under the various subject headings described above. Table 2 summarizes the studies proposed under this research plan and identifies their priority and duration.

Table 1. Summary of Proposed Research Projects

TIMING	ECOLOGICAL COMPONENT	USER BEHAVIOR COMPONENT	SOCIO-ECONOMIC COMPONENT	MANAGERIAL COMPONENT	GENERAL
1985 - 86					
Principal Projects	Evaluation of Resource Impacts--Reconnaissance Resource Impact Monitoring and Assessment System Impacts from Trespass--Reconnaissance	Initiation of Research on Experiences of Clientele Groups	Community Analysis Outfitter Study	Legislative Analysis Management System Analysis	Use Levels and Distribution--Potential Indicators
Secondary Projects	Impacts on Fish and Wildlife--Assessment Site Recovery and Rehabilitation-Assessment		Regional Economic Impact		
1986 - 87					
Principal Projects	Evaluation of Resource Impacts-Study Impacts from Trespass--Monitoring	Definition and Specification of Clientele Group Experiences	Community Analysis Outfitter Study--Extension of Study to Explore Role of Outfitters in Management Regional Supply and Demand	Economic Efficiency Analysis	Evaluate Use Monitoring Systems
Secondary Projects	Site Recovery and Rehabilitation-Study Impacts on Fish and Wildlife-Study		Expansion of Above Research to Include Latent Users		
1987 - 88 and Beyond					Management Technology Evaluation of Management Strategies

Table 2. Project Summary: Priority and timing.

Component	Priority	Project	Duration
Ecological	1	Evaluation of Resource Impacts-- Reconnaissance	5/85-5/86
Ecological	1	Resource Impact Monitoring and Assessment System	5/85-1/87
Ecological	1	Impacts from Trespass-- Reconnaissance	7/85-6/86
Ecological	1	Impacts on Fish and Wildlife-- Assessment	6/85-6/86
Ecological	1	Evaluation of Resource Impacts-- Study	6/86-1/88
Ecological	1	Impacts from Trespass--Monitoring	6/86-10/87
User Behavior	1	Initiation of Research on Experiences of Clientele Groups	4/85-12/85
User Behavior	1	Definition and Specification of Clientele Group Experiences	1/86-12/87
User Behavior	1	Evaluation of Management Strategies	1/88-12/89 ^a
Socio-Economic	1	Community Analysis	4/85-4/87
Socio-Economic	1	Outfitter Study	6/85-6/86
Socio-Economic	1	Outfitter Study Extension to Explore Role in Management	6/86-6/88 ^a
Socio-Economic	1	Regional Supply and Demand	6/86-5/87
Managerial	1	Legislative Analysis	1/85-6/86
Managerial	1	Management System Analysis	4/85-6/87
Ecological	2	Site Recovery and Rehabilitation-- Assessment	5/85-6/86 ^b
Ecological	2	Site Recovery and Rehabilitation-- Study	6/86-1/91
Ecological	2	Impacts on Fish and Wildlife-- Study or Studies	6/86-6/88 ^a
User Behavior	2	Expansion of Research to Include Latent Users	1/86-12/87

Table 2 - continued

Component	Priority	Project	Duration
Socio-Economic	2	Regional Economic Impact	6/85-5/86
Socio-Economic	2	Economic Efficiency Analysis	5/86-6/88
Managerial	2	Management Technology	6/87-6/89 ^a
General	2	Use Levels and Distribution	3/86-12/86
General	2	Evaluation of Use Monitoring Systems	3/87-12/88

^aContingent on outcomes of earlier research.

^bDone in conjunction with evaluation of resource impacts reconnaissance.

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