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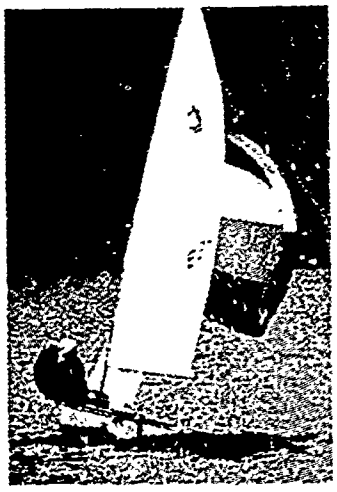

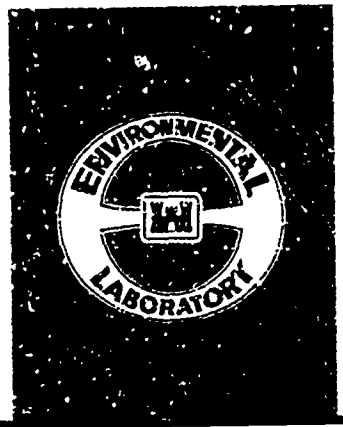

NATURAL RESOURCES
RESEARCH PROGRAM

MISCELLANEOUS PAPER R-92-2

PROCEEDINGS, 16TH ANNUAL MEETING, NATURAL RESOURCES RESEARCH PROGRAM

16-17 APRIL 1991
NASHVILLE, TENNESSEE

February 1992
Final Report

Approved For Public Release; Distribution Is Unlimited

Prepared for DEPARTMENT OF THE ARMY
US Army Corps of Engineers
Washington, DC 20314-1000

Published by Environmental Laboratory
US Army Engineer Waterways Experiment Station
3909 Halls Ferry Road, Vicksburg, Mississippi 39180-6199

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REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	February 1992	Final report

4. TITLE AND SUBTITLE
Proceedings, 16th Annual Meeting, Natural Resources Research Program; 16-17 April 1991, Nashville, Tennessee

5. FUNDING NUMBERS

6. AUTHOR(S)

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
US Army Corps of Engineers, Washington, DC 20314-1000; US Army Engineer Waterways Experiment Station, Environmental Laboratory, 3909 Halls Ferry Road, Vicksburg, MS 39180-6199

10. SPONSORING/MONITORING AGENCY REPORT NUMBER
Miscellaneous Paper R-92-2

11. SUPPLEMENTARY NOTES
Available from National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161.

12a. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution is unlimited.

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

The 16th Annual Meeting of the US Army Corps of Engineers Natural Resources Research Program was held in Nashville, TN, on 16-17 April 1991 to review current research activities, discuss future research, and afford the opportunity for presentation of operational needs. Papers presented at the meeting are included in this report.

14. SUBJECT TERMS
Natural resources
Operations
Program review
Recreation

15. NUMBER OF PAGES
61

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18 SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED	UNCLASSIFIED		

Contents

Preface

The 16th Annual Meeting of the US Army Corps of Engineers Natural Resources Research Program was conducted in Nashville, TN on 16-17 April 1991. The program review, required by the Directorate of Research and Development, was organized by personnel of the Natural Resources Research Program (NRRP), which is managed under the Environmental Resources Research and Assistance Programs (ERRAP) of the Environmental Laboratory (EL), US Army Engineer Waterways Experiment Station (WES), Vicksburg, MS.

Presentations by WES personnel were prepared under the general supervision of Dr. John Harrison, Chief, EL. Mr. J. Lewis Decell was Program Manager, ERRAP. Ms. Judy Rice (CECW-ON) and Mr. Robert Daniel (CECW-PD) were Technical Monitors for the Headquarters, US Army Corps of Engineers.

Dr. A. J. Anderson, Assistant Program Manager, ERRAP, and Ms. Billie H. Skinner, Program Managers Office, EL, coordinated the organizational activities of the meeting and efforts leading to the publication of this report. The report was edited by Ms. Janean Shirley of the WES Information Technology Laboratory (ITL). Ms. Betty Watson, ITL, designed and composed the layout.

Commander and Director of WES was COL Larry B. Fulton, EN. Technical Director was Dr. Robert W. Whalin.

Agenda

Tuesday, 16 April 1991

8:00 a.m.	Welcome
8:10 a.m.	Announcements and General Comments - Dr. A. J. Anderson, WES
8:15 a.m.	NRRP Technical Monitor - Judith Rice
8:30 a.m.	Dr. John Crompton - Texas A&M University
9:15 a.m.	David Mihalic - Superintendent, Mammoth Cave National Park
9:45 a.m.	*Break*
10:05 a.m.	ORD Panel - Ron Rains, Moderator
10:40 a.m.	Lewis Decell, Manager, Environmental Resources Research and Assistance Programs, WES

NRTS Studies

11:00 a.m.	Visitation Estimation & Reporting System (VERS) - M. Kathleen Perales
11:15 a.m.	A Natural Resources Management Framework and Its Application to Economic Impact Assessment - R. Scott Jackson
11:45 a.m.	*Lunch*

Proposed Work Units

1:00 p.m.	375-1	Measuring Economic Impacts of Dispersed Recreation - R. Scott Jackson
1:15 p.m.	375-2	Impacts of CE Projects on Local Real Estate Taxes - R. Scott Jackson
1:30 p.m.	375-3	Effect of Reservoir Operations on Recreational Fisheries - K. Jack Killgore, R. Scott Jackson , and Richard Kasul
1:50 p.m.	375-4	Development of Wildlife Inventory Procedures for Corps O&M Projects - Chester O. Martin

Current Work Units

2:05 p.m.	32728 Management of Water-Based Recreation Opportunities: First Year Status - John Titre
2:25 p.m.	32745 A General Approach for Measuring the Effects of Alternative Fee Programs - R. Scott Jackson and H. Roger Hamilton
2:45 p.m.	*Break*
3:00 p.m.	Division, District & Project Breakout Session - Sherman Gee, Moderator
4:30 p.m.	*Adjourn*
5:30 p.m.	*Reception* (cash bar)

WEDNESDAY, 17 April 1991

8:00 a.m.	Announcements - Dr. A. J. Anderson
8:15 a.m.	Report on Breakout Session - Sherman Gee

Current Work Units

8:45 a.m.	32744 Recent Developments in Campground Receipt Study Data Collection - Tere DeMoss
9:05 a.m.	32349 Estimating Dispersed Recreation Use in Multiple Access Settings - Kathy King Mengak and M. Kathleen Perales
9:20 a.m.	32574 Regional Recreation Demand Models - Jim Henderson
9:45 a.m.	*Break*

FY92 Civil Works R&D Program Review

10:05 a.m.	Announcements - William Rushing, CERD-C
10:15 a.m.	Questions and Answers
10:30 a.m.	Preparation and Submission of Input Forms
11:50 a.m.	Adjourn FY92 Natural Resources Research Program Review
12:00 p.m.	*Lunch*
1:00 p.m.	Field Trip to Mammoth Cave National Park, KY
5:00 p.m.	Conclude tour of Mammoth Cave National Park, KY
5:30 p.m.	Dinner - Local Restaurant
7:30 p.m.	Bus Departs for Nashville, TN
9:00 p.m.	Bus Arrives Hotel, Nashville, TN

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Introduction

The annual meeting of the Corps of Engineers Natural Resources Research Program (NRRP) provides professional presentations of current research and discussions related to Corps activities and problems. In conjunction with this meeting, the Civil Works Research and Development Program Review is held. This review is attended by the Technical Monitors and representatives of the Civil Works Research and Development Directorate of the Headquarters, US Army Corps of Engineers (HQUSACE); the Program Manager, NRRP; researchers; and representatives of the operations and planning elements of the Corps Division, District, and Project offices, including those designated as Field Review Group (FRG) members of the research program.

The overall objective of this annual meeting is to thoroughly review the Corps' natural resources/recreation needs and establish priorities for future research, such that identified needs are satisfied in a timely manner.

The technical findings of each research effort conducted under the NRRP are reported to the Manager, NRRP, US Army Engineer Waterways Experiment Station, in the form of quarterly progress reports and as miscellaneous papers, instruction reports, and technical reports. The miscellaneous papers, instruction reports, and technical reports are distributed widely in order to transfer technology to both the operating elements and the technical community.

Technology transfer is also accomplished through the Natural Resources Technical Support Program (NRTS), through the publication of the information exchange bulletin *RECNOTES*, and the conduct of workshops. Upon request, NRTS provides direct assistance to the operating elements and the HQUSACE regarding problems that need rapid application of technology.

The printed proceedings of the annual meetings and program reviews are intended to provide Corps management and the FRG with an annual summary to ensure that the research is being properly focused on the Corps' operational needs nationwide.

The contents of this report include the presentation and discussions of the 16th Annual Meeting held in Nashville, TN, on 16-17 April 1991.

Comments from Natural Resources Management Branch, HQUSACE

by
Judy Rice[1]

Good morning. These research meetings are always such interesting events. If you remember 2 years ago in Omaha, we were in an uproar over a $34-million budget cut and the closing of 25 percent of our recreation areas. This year, we have the Corps-proposed reorganization to think about. Well, I'm going to ask that you all interrupt your searches for new jobs and think about the research program for these next 2 days.

First of all, I would like to compliment Lewis and Andy and Roger and all the Principal Investigators (PI's) for the successes of this last year. There was an impressive amount of work accomplished, in spite of the usual funding and staffing constraints. Among the accomplishments in the research program since our last program review are:

a. The reevaluation and redesignation of field review group members and points of contact for the research program. We have a bigger list of these folks after the review - we've included more planning people, and in some cases have dual representation from planning and operations elements. I think that's great - the more people we can get intimately involved in the program, the more relevant the program will become and the more clout we'll have. And all these people have presumably considered their involvement in the program, decided it is a worthwhile use of their time, and recommitted themselves to active participation. Now, every year at program review, I recommit myself to the program. It's easy to get all fired up while I'm here and hearing about all the good stuff we're doing and are going to do. And then, I get back to my office and all the other alligators surface - equally important alligators - to nibble away at my time. Well, that's the case with all of us; we have too many top priorities, but I think it is very beneficial that all of us here have made that recommitment to the program. Fortunately, when we go home and have to shoo other program alligators, the US Army Engineer Waterways Experiment Station (WES) staff is still thinking about research. And, as a consequence, the program continues and lots of good work gets done. For instance, also this year:

b. The Visitation Estimation and Reporting System (VERS) was completed. We are planning four workshops this year in June, July, August, and September to train District coordinators in the system. And we have sent a memo to the field directing the use of VERS beginning 1 October 1991. This is something we have been working towards for years, and I think the implementation of VERS will allow us to make major progress in improving our visitation. None of the other Federal recreation-providing agencies have anything like VERS right now. We plan to present VERS at the next interagency fee task force meeting, usually held in July and hosted by the National Park Service, to show the other agencies how our estimation process works. And I understand Scott and Kathy are planning a session at the NRPA national

[1] NRRP Technical Monitor, Natural Resources Management Branch.

conference in October in Baltimore on the system. So, we will get some well-deserved, good visibility from it.

c. The FY91 version of the Automated Use Permit System (AUPS) was delivered to the field as scheduled. This was accomplished in spite of a short staffing situation at WES.

d. Work was completed on the economic impact study, although the reports have not made it through the system yet. This was a major study with implications for further work in various areas.

e. The report was published for the CY88 Campground Receipt Study, and number crunching was done for the FY89 and FY90 reports. These reports have taken a while to get out in the past for various reasons, but we've come a long way in catching up this year.

f. Some of the preliminary work for the Regional Recreation Demand Model and Water-Based Recreation Opportunities work units has been well started, and we're getting some idea of where we want to go with Measuring the Effects of Alternative Recreation Fee Programs. The PI's will be presenting this work to you later.

g. The PI's provided timely responses to the usual load of Natural Resources Technical Support (NRTS) requests.

h. We decided to get off dead center on the regional load factors issue. We will use NRTS funding to study the feasibility of developing some meaningful regional factors, to determine what we might lose in accuracy, and to determine if the data currently available are sufficient to develop valid regional factors or if additional surveying might be necessary.

i. In the interest of improving communications, Lewis and Andy have agreed to publish periodically in *RECNOTES* a summary of the ongoing work units and the status of scheduled milestones and products. This proposal goes hand-in-hand with a suggestion made during last year's break-out session to have a summary of NRTS efforts and reimbursable work provided to the field for improved communications.

j. Other suggestions from last year's breakout session were implemented this year.

k. We tried to maintain a sharper awareness of the distinction between policy and research and who is responsible for which, although in an applied research effort like ours, the two are intimately interconnected.

l. *RECNOTES* was published more regularly, in accordance with an established schedule.

m. New work units are being presented here before the breakout session this year, so they may be discussed knowledgeably by program review participants.

n. Proposals were developed for new work unit starts in response to concerns you expressed at last year's program review and throughout the year. For instance, there was a lot of interest in further economic impact work, but it was pretty general interest. We didn't exactly know where we wanted to go with it - we just knew we weren't there yet. WES has developed some specific proposals for your consideration in the area of economic impact.

I am very pleased with the proposals for new starts. I think they illustrate success in the area of improved communication that Lewis has been working on, in that they respond directly to your expressed concerns. It may seem academic at this point and not very important to have a queue of possible new starts for the Natural Resources Research Program (NRRP). After all, there isn't much funding for new research - but just because there's little money doesn't mean there's little need. And, as Lewis has been coaching

me, the best way to capture more money is to prove we need it.

Which leads me to, "Where do we go from here?" Usually, I have to find that out from you. So, I'm going to say some things you probably already know. Overall funding for the Research and Development (R&D) program is probably not going to increase much, realistically, in the near future. In FY92, ongoing work in current work units will require most, if not all, the funding currently scheduled for us. For any new work that we consider imperative, we will have to make a strong case to the R&D committee to fund, realizing that our gain is a loss to some other research program. Or, we can use NRTS money for some short turnaround things, such as the Regional Load Factors investigation.

The key here is to maintain a relevant program that addresses our needs in a cost-efficient manner and which produces usable, credible products in a timely fashion. And that requires our continuing communication and cooperation in: (a) defining and identifying needs, and then (b) focusing work units - both current and new - to meet those needs. Which is, of course, why we are here this week.

These meetings can get really lively and interesting. You have to pay close attention here or you can get slapped up the side of the head with a renegade dynamic! You each have some definite opinions about the program, and you aren't reluctant to share them. Some of you are, in fact, less reluctant to share than others - but, that's great! It means you care about the program and are willing to be involved. I fully expect, in short, that this will be another interesting meeting.

I hope I haven't stolen too much thunder from the PI's as they present their work units to us today, but I did want to highlight the accomplishments of this past year and express my appreciation for the conscientious efforts of the WES staff.

Natural Resources Research Program 1991

by
J. L. Decell, Manager[1]

The focus of my comments will be to report on items that were identified during the breakout session of the 1990 meeting, attended by Division, District, and Project personnel.

Before reporting on those items, I would like to briefly review where we were in 1988 and things that have been discussed and implemented prior to and since the 1990 meeting. I think that it is necessary to review this short history, in order to put our present status in the proper perspective. There is equal danger in perceiving too much progress as there is in not recognizing progress that has been made. It is important that we recognize that we set a course for improvement 3 years ago, began to initiate actions to pursue certain goals, and that through persistent pursuit of those objectives, have achieved many. Any one may seem small in and of itself, but when taken as part of an overall effort, the progress should not be taken lightly.

In 1988, the Natural Resources Research Program (NRRP) was the target of criticism from the field and from Headquarters. Mainly, the criticism focused on missed milestones, and on research that either did not serve the field needs or did not clearly indicate how it would. Communications between the NRRP and the field were not effective and certainly not productive. Consequently, the credibility of the NRRP's efforts was not what it needed to be. Headquarters, in the absence of good communications between the field and research, assumed the role of referee and often necessarily was required to dictate the how and what of research efforts. In my opinion, it was a role that was not by choice, but had to be assumed.

I set some goals in 1988, some short-term, most long-term, but all were equally important in my strategy to improve the stature and performance of the NRRP. These were:

a. To hold each year's meeting in a different Division, and to incorporate the Civil Works Research and Development (R&D) Program review as an integral part. To have participation by the host Division, as well as participation by invited speakers from other Federal or State agencies or universities. To encourage project attendance and participation at these meetings. In addition, I committed to publishing Proceedings of each year's meeting to provide a record of the things that were important to both the field and research.

b. To have the field recognize the research program as *theirs*. The NRRP is not a US Army Engineer Waterways Experiment Station (WES) program, nor is it a Headquarters program. The NRRP is the field's vehicle for developing the technology needed to provide itself with problem-solving capabilities.

c. To have the NRRP recognized as a national leader in technology development for recreation and natural resources management.

Our first meeting after the reorganization was hosted by the Missouri River Division (MRD) and Don Dunwoody, and many of these goals and expectations were set down in the Proceedings of that meeting. At that meeting Darrell Lewis identified four priorities that he had for the NRRP:

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[1] US Army Engineer Waterways Experiment Station, Vicksburg, MS.

a. Integration into the mainstream of Corps Planning and Operations activities.

b. Doing quality research.

c. Involving research on a timely basis.

d. Maintaining a pipeline for identifying research needs.

He also stressed the need to communicate, which was reinforced at the subsequent meeting in Atlanta in 1990, and noted that "the very nature of research demands rational decisions and a vision for the long term." He challenged "this group" to provide that stability and vision. I have been cognizant of these factors in my subsequent efforts.

At the 1990 meeting hosted by the South Atlantic Division (SAD) and Gerald Purvis, Judy Rice noted some of her observations since the 1989 meeting. She noted some amount of general progress. Rightfully she noted the following:

a. A complete lack of research topics from the field.

b. Limited funding for the NRRP.

c. Efficiency at utilizing the limited funding.

d. Research taking too long to produce results.

e. Too much time taken to initiate work after need is identified.

f. Improvement in work unit documentation - still room for improvement.

g. A need for improvement in communications.

h. Failure to hold a fall meeting of the NRRP Field Review Group (FRG).

i. Importance of the Economic Impact work.

Susan Whittington noted that the biggest problem was a lack of communication about how the program works and how it can benefit the practitioner.

Having reviewed some of the recent history that brought us to this year and our current status, let me return to the business at hand and report to you what has and/or has not been done about items identified from the 1990 breakout session, as published in the Proceedings of that meeting.

The breakout group concentrated their discussions on the following items that they thought might improve the program:

Work Unit Titles: The group felt that there had been some confusion in the past because work unit titles have been changed. They stated that titles should be appropriate for the description of work, and titles should not be changed in subsequent years without full coordination and notification.

> *Status*: During the last 2 years, the work unit on Operational Management Plans was re-titled at the request of the field during the 1989 review. This FY, the Research and Demonstration System (RDS) work unit was re-titled as RDS-Evaluation of Camping Trends at Corps Projects, to more accurately reflect what type of work is being conducted, and to coincide with the description of work.

Accountability for reimbursable work and Natural Resources Technical Support (NRTS) assistance. The group stated that natural resource offices receiving reimbursable research work and NRTS assistance should be accountable for providing feedback to the researchers. They recommended that a form be provided with each product for providing these comments.

> *Status*: This was discussed with Corps of Engineers Research and Development - Civil (CERD-C), and is a subject that has come up in other areas before. They are treading softly, because they don't want it to become a requirement. Sponsors of reimbursable research can send evaluations to WES at any time. The same holds for those receiving NRTS assistance. As stated by the group, the burden of *accountability* rests with the natural

resource offices. As such, they should design their own format, or simply take the initiative to provide feedback by official letter. I suspect that if that initiative is not already in place, providing a fill-in-the-blanks vehicle will not create it. I do not intend to design and provide such forms.

Policy versus Research. The group felt that WES was making policy.

Status: First let me say that WES knows it is not our role to make policy, nor does it want to be in the business. I think this issue peaked as a result of some confusion during the transition of the Automated Use Permit System (AUPS) to an operational status. During that time, field personnel were *asking* WES for assistance for things that were solvable by policy changes - not technical changes. At times certain people at WES, in an effort to respond, did not take time to make the distinction between the two. With the creation of the AUPS policy committee and the user group, I think this confusion has been greatly reduced, if not eliminated.

Information Transfer.

a. ***RECNOTES.*** The group requested that *RECNOTES* be published quarterly, and should be a mix of research and operations materials. Also, the contents and frequency of publishing should be evaluated at future annual research meetings.

Status: A quarterly schedule has been established for RECNOTES. Articles are being solicited from both research and operations. In order to consistently publish once each quarter, we need a backlog of two to three articles so we can keep the pipeline full. Although I have requested that the field provide articles, we get very few, and I think we could do better here.

b. **NRTS/Research Summaries.** The group suggested that annual summaries of NRTS and Reimbursable Research be provided to the field.

Status: Nothing was done this past FY, as the annual report of NRTS activities was provided only to (CECW-ON) and the handling of a report on reimbursable research took some time to identify a central location that maintained such information. I will publish and distribute these reports this FY in some form, possibly a *RECNOTES* article, if appropriate.

c. **Dropping Work Units.** The group felt that a process needs to be implemented for dropping work units when:

1. Enough research has been provided.
2. Research is obsolete.
3. Research dollars could be better spent elsewhere.

Status: There already exists a process for dropping work units before they are completed. It is the CW R&D Program reviews, my subsequent recommendations, and commensurate decisions by the Technical Monitor that determine a work unit's fate. The work unit on Operational Management Plans was terminated as a result of this process. I think part of the problem here is that work units were started prematurely, and without a clear understanding, on both sides, as to what was to be done and what the product would be. Starting work units from this basis would greatly reduce the urge to stop them prior to their originally scheduled completion. I hope this has or is changing for the better in the last 2-3 years, as a result of our efforts for better communications. An active FRG could provide productive input to this part of the system.

The above criteria are weak in terms of being useful and accomplishing what the field says they want. What constitutes "enough?" How does one define or determine "obsolescence?" And as long as needs are changing and funds are short, anyone can make a case for better spending of research dollars - elsewhere.

Every research program needs continuity over the long term. To build in a process designed specifically to *stop* work is short-sighted and counterproductive. We need to do a better job of making sure that the research is addressing the *emerging* problems; that there is sound and knowledgeable field support (the need *should* come from them); that when the commitment is made for *initiating* the work, it includes the commitment to *complete* the work.

This can only be accomplished when the research is consistently completed on time and with a quality useful product. I have never asked anything else from the researchers, and if they do not consistently meet these requirements, I would not ask the field for their commitment.

d. **Submission of research ideas.** The group agreed that the process for nominating ideas for research is not working. They identified three areas:

1. The list of FRG members should be reevaluated, updated, and distributed.
2. *RECNOTES* should include a short form for submission of ideas from the field.
3. Headquarters and WES need to discuss ways of improving the process.

Status: (1) Headquarters has done this. They even requested that new FRG members be identified. (2) A form will be transmitted to the field via a *RECNOTES* articles to solicit research topics. (3) This is ongoing. Headquarters' efforts to establish an "actively participating" FRG and points of contact (POC's) will hopefully help this situation.

e. **New Work Units.** The group recommended that the breakout session convene *after* the presentation of new work units, and that the input form be revised to include a "kill" column for each work unit.

Status: This year's agenda has been structured to complete the presentations on new work units prior to convening the breakout session. No kill column will be added to the input sheet. This reflects the potential for precipitous decision making and defeats the purpose of the entire review process, which is for the field and research to focus on the long-term, future needs of the Corps' overall program.

I can tell you that we have made significant progress during the last 2 years. We have successfully transitioned AUPS to an operational program. We have completed the Visitation Estimation and Reporting System (VERS) and it is being implemented as an operational program. We have made significant progress in the Economic Impact work, including two special efforts taken on relative to performance indicators and the recreation study. This FY we will have caught up on the analysis and publication of the Campground Receipt Study (CRS), and by the end of FY 91, we will be up to date on that work.

I intend to continue to pursue the objective of having the NRRP recognized by you as *your* program - the field's. From a program management standpoint, I will implement those appropriate suggestions from last year and those that are presented this year that are in keeping with the pursuit of the long-range objective(s). With your constructive input and active participation, it is happening and will continue to happen. Without it, the program is stagnant.

A Natural Resources Management Framework and Its Application To Economic Impact Assessment

by
R. Scott Jackson[1]

Introduction

Determining the economic implications of management actions has become a capability required by resource management agencies. Decisions on the allocation of natural resources, the distribution of scarce operating dollars and adjustments to the management of recreation areas may affect the amount and distribution of recreation use at a project. The outcome of many resource management issues is being influenced by the ways in which decisions will affect local economic conditions. The economies of many regions of the United States have grown up as a result of tourist spending influenced by the attractions provided by public resource management agencies (Alward 1986). Recent research by the Corps of Engineers and other agencies has focused on the development of recreation visitor spending profiles and economic impact modelling capabilities in order to translate changes in recreation use into shifts in jobs and income in the local economy. Additional information, however, is required to identify the economic implications of management actions.

Purpose

The purpose of this paper is to propose a framework for examining the relationship between investments made in natural resource management at Corps of Engineers (CE) projects and outputs resulting from those investments. In addition, the paper presents a process for examining the economic impacts of management actions to demonstrate the broader need to link management investments to project outputs.

Program Inputs and Outputs

The current economic impact work unit (Work Unit No. 32269) is designed to measure the linkage between recreation use and employment and income generated from visitor spending. To fully understand the economic implications of management decisions we need to broaden investigations to understand the linkages between the activities that managing agencies directly control (program inputs) and the products and services generated from management activities (program outputs). Figure 1 illustrates inputs and outputs associated with the Corps' Natural Resources Management Program.

Agencies manage by determining the appropriate mix of inputs into the Natural Resources Management Program. For instance, an agency could lower the level of a lake, which could impact the recreation program by reducing visitation to the lake. This reduction in visitation could adversely impact the local economy. While the results of current Natural Resources Research Program (NRRP) economic impact research can be used to translate visitation changes into economic impacts, in our example, additional information is required to make the link between changes in lake level and visitation.

Program inputs under the control of the Natural Resources Manager include project land and water resources, project operations activities, facilities, budgets, and personnel. Additional program inputs are provided by commercial providers, such as concession operators and other Federal, State, and local public agencies. Changes in the mix of these program inputs will affect the products and

[1] US Army Engineer Waterways Experiment Station, Vicksburg, MS.

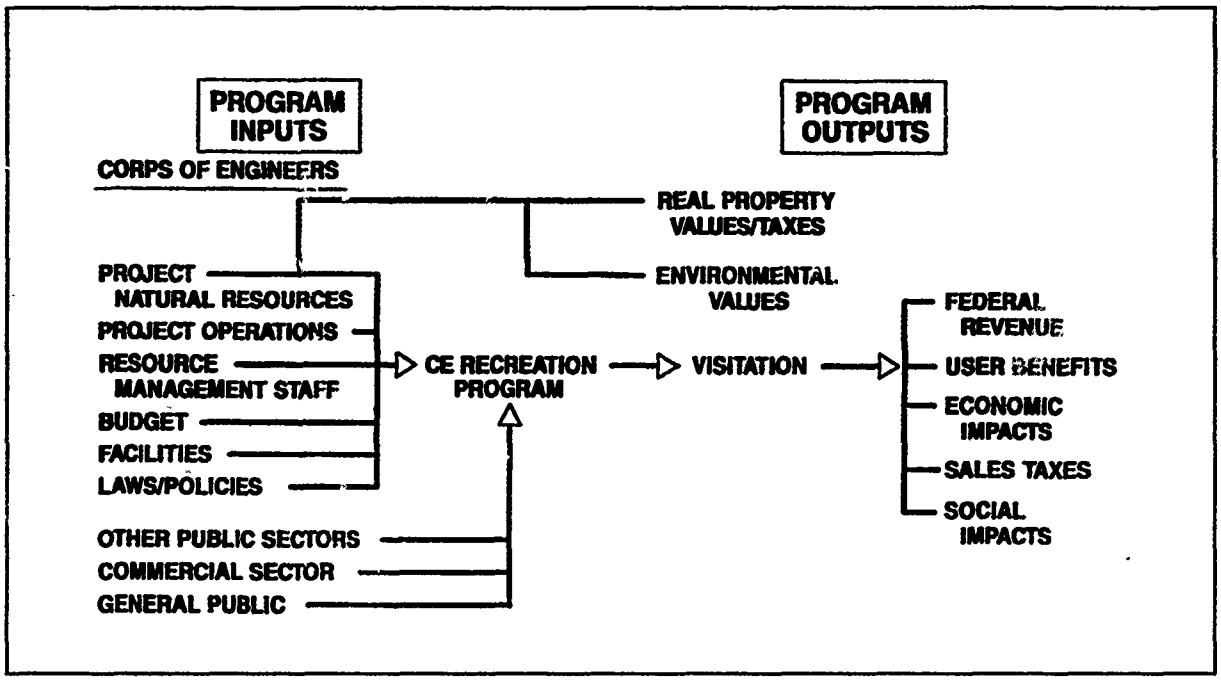

Figure 1. Corps Natural Resources Management Program inputs and outputs

services provided by the agency. Additionally changes in policies and statutes affecting the agency will affect operating conditions. Finally, the general public has to be viewed as an input into the program. Public preferences for recreation activities and resources play an important role in shaping agency policy and, therefore, must be considered a part of the "input mix."

Outputs associated with the Natural Resources Management Program are varied and benefit different segments of society. Users directly benefit from programs through the provision of recreation opportunities. Businesses benefit from programs through increased business stimulated by recreation-related spending. Local units of government benefit through increased sales taxes generated from recreation spending. Landowners adjacent to Corps projects benefit through increased property values stemming from amenity values created by Corps projects. Revenues are generated through use fees that are returned in part to managing agencies.

Research activities in the NRRP generally fall into two major categories. Some work units are designed to improve the agency's capability to measure program inputs or outputs. Examples of this type of research include the development of the Visitation Estimation and Reporting System (VERS) and the economic impact research. Some work units are designed to establish linkages between inputs and outputs. The ongoing regional demand modeling work unit and the proposed fisheries work unit are examples of research that will examine the relationship between agency activities and outputs generated by the Natural Resources Management Program. To develop the capability to fully assess the economic implication of management activities requires both categories of research.

Economic Impact Assessment Process

Several steps are generally required to determine the economic impacts of management actions. Figure 2 outlines the process of assessing economic impacts beginning with monitoring current recreation use and carries through to determining employment effects. The following discussion describes the tools required to conduct economic impact evaluations. Many of these tools exist or are in the process of being developed.

Step 1—Measure Existing Use Patterns. The basis for all assessment of economic impacts related to recreation begins with an understanding of baseline recreation use conditions.

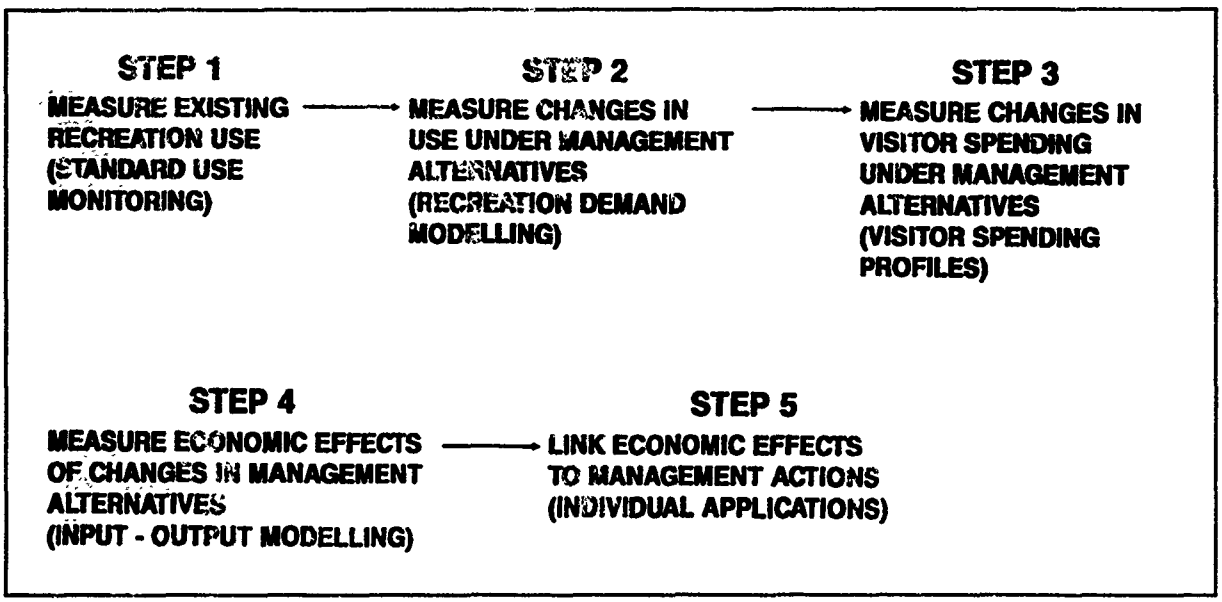

Figure 2. Economic impact assessment process

Systematically monitoring recreation use over time using standardized procedures provides the opportunity to identify changes in recreation use that might result from changes in management activities, resource conditions, or user characteristics. Without this monitoring activity indirect methods to approximate recreation use would be required. Two NRRP work units are providing tools to measure recreation use at developed and dispersed recreation areas. The VERS was developed to measure and report recreation use at developed recreation areas. The system is complete and workshops are being conducted to train Corps staff in its use. A work unit on dispersed recreation use estimation will be completed in FY 92. This effort will result in general procedures for measuring dispersed recreation use on undeveloped lands and those associated with riparian households.

Step 2—Measure Change in Use Under Management Alternatives. Most economic impact studies are designed to determine what will happen to the economy if something occurs; constructing a marina, the drawdown of a reservoir, closing a recreation area. In order to accurately gage how an economy would change under these actions it must first be determined how recreation use patterns would change. When water levels in a reservoir are drawn down, a portion of the current visitors to that lake may simply shift their visits to other substitute lakes in the region, in which case there may be little effect on the local economy. However, those visitors that cease to visit the region will affect the local economy to the extent that their recreation spending will shift to other regions where substitute lakes exist. Recreation demand models can be designed to predict how recreation use will change under alterations in site conditions and user characteristics. An existing NRRP work unit is underway to develop demand models that would predict changes in recreation demand associated with changes in existing Corps projects and users. A further description of the NRRP demand modelling research can be found in documentation for Work Unit No. 32574. Several states and other research groups have developed demand models for specific regions of the country that may be useful in some Corps applications.

Additional existing and proposed NRRP studies are relevant to this step in economic assessment process. Work Unit No. 32745, "Measuring the Effect of Alternative Recreation Fee Programs," will examine how visitors will respond to different recreation fee options, including the imposition of day-use fees. This work unit will also address estimated loss in visitation associated with changes in fee programs. This change in use patterns is a necessary step if the economic impact of fee policies is to be determined.

A proposed work unit on the relationship between reservoir operations and fisheries resources (Work Unit No. 375-3) can be used to translate reservoir operations into recreation-related economic impacts by determining how recreation use is influenced by the changes in fisheries conditions resulting from reservoir operations.

Step 3—Measure Changes in Visitor Spending Under Management Alternatives. This step translates changes in recreation use (Step 2) into changes in visitor spending resulting from a management action. Direct surveys of visitors are used to develop visitor spending profiles that describe the average amount visitors spend on durable goods and trip-related goods and services consumed during recreation visits to Corps projects. Survey results indicate that campers and day users spend at different rates and for different items. Day visitors to Corps projects that stay overnight at adjacent motels and other commercial accommodations spend at higher rates than either campers or true day users. Surveys at nationally representative Corps projects as a part of NRRP work units have been used to develop visitor spending profiles that can support a variety of economic impact studies. In addition, regional visitor spending surveys in the Mississippi, Missouri, and Columbia River Basins will provide additional spending profiles that will be available to support Corps applications. The majority of Corps spending surveys conducted to date have focused on visitors using public recreation areas at Corps projects. A proposed work unit, "Measuring Economic Impacts of Dispersed Recreation," (Work Unit No. 375-1) will develop spending profiles for users of undeveloped Corps lands and riparian homeowners living adjacent to Corps projects.

Step 4—Measure Economic Impacts of Management Alternatives. This step in the process translates visitor spending into jobs and income resulting from visitor spending. Different regions have different capabilities to generate local economic impacts depending on the level of economic activity in the region. Large urban regions with wholesale and manufacturing sectors presently provide greater economic impacts per dollar of visitor spending as compared to rural regions with primarily retail economic sectors present. Economic Input/Output models are effective tools in determining how specific regions translate visitor spending into local employment and income. These models provide estimates of economic impacts based directly on economic conditions in the specific region under study. The use of input/output models is the most precise way of measuring economic impacts. However, this approach requires access to those models and skills necessary to use input/output models and interpret model output. The existing NRRP economic impact work unit (Work Unit No. 32269) will support input/output model applications. The spending profiles described in Step 3 are organized to meet the requirements of IMPLAN (a US Forest Service Economic Input/Output Model). With some modification, spending profiles can be used in other Input/Output models.

For many economic impact applications, less precise "ballpark estimates" may suffice. The use of economic multipliers can be derived from economic models developed for representative regions in which Corps projects are located. Models developed for these representative regions can be used to create multipliers that can be directly applied to visitor spending estimates to estimate local income and employment resulting from visitor spending. This "shortcut" approach, while not as precise as developing regional economic models, can be done more quickly without requiring the development of models.

Step 5—Link Economic Effects to Management Actions. Increased participation by non-Federal interests in the management of Corps projects has led to the need to expand the Corps' capability to assess the economic impacts of management actions and routinely use the economic impact assessment process in Corps management and planning activities. Recent resource allocation decisions on the Mississippi, Missouri, and Columbia River Basins demonstrate the need to understand the regional economic implications of a variety of management alternatives that will affect populations in all basin states. The use of the process described here is necessary to precisely identify the economic importance of recreation opportunities provided by these river basins and how local economies would be affected by changes in recreation resources resulting from alternative management actions. This

process allows tradeoffs to be made between recreation and other project outputs (e.g., hydropower production, flood control, water supply, and navigation) based on equivalent measures of all project outputs.

Similar emphasis has been placed on understanding the economic impact of recreation use at existing projects. One of the natural resource management performance indicators identified by Headquarters, US Army Corps of Engineers (HQUSACE) measures economic activity generated from Corps recreation programs. Specifically, the economic impact performance indicator measures the amount visitors spend on trip expenditures (e.g., food, gas, lodging) per dollar the Corps spends for recreation programs (Jackson and Rogers 1990). This performance indicator was developed for all Corps Projects, Districts, and Divisions.

The economic impact performance indicator could be expanded to estimate jobs and income generated by visitor spending at existing Corps projects through the use of the income and employment multipliers described in Step 4. This would more completely describe the economic impacts associated with recreation use at Corps projects.

Conclusions

Many initiatives of HQUSACE and the NRRP have been directed toward developing procedures to either measure project inputs and outputs (e.g., project cost tracking, VERS, economic impact assessment procedures) or to examine the relationship between project inputs and outputs (e.g., regional recreation demand modelling, measuring the effects of alternative fee programs, impacts of reservoir operations on fisheries and recreation). The proposed framework that describes the relationship between project inputs and outputs is a starting point to identify the application of completed research and identify research needs. A refinement of this framework through a rigorous review of information requirements by field personnel would aid in identifying future research needs.

The economic impact assessment procedure presented here demonstrates the need to integrate research activities in order to establish links between project inputs and outputs. Research needs have been identified in the discussion of this procedure that will improve our understanding of linkages and more efficiently measure project economic outputs.

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Effect of Reservoir Operations on Recreational Fisheries

by

K. Jack Killgore,[1] *R. Scott Jackson,*[1] *and Richard Kasul*[1]

Introduction

There is a growing public interest in the priority given to recreational fisheries in the operation of reservoirs. The extent of this interest is indicated by data showing that in 1980, nearly 40 percent of all freshwater fishing activity occurred in reservoirs, accounting for nearly 272 million days of fishing and $5.4 billion of expenditures (Fisher, Charbonneau, and Hay 1986). However, there is concern that habitat quality is deteriorating in many aging Corps of Engineer (CE) reservoirs and that the recreational fishery is declining. Such concerns are often expressed as criticism of reservoir operations, particularly of activities that inhibit fish movements and alter the physical and chemical characteristic of reservoir and tailwater environments.

Water-management alternatives affect the distribution, stability, and quality of reservoir fisheries, which in turn influence the recreationist's willingness to pay for angling and other recreational uses (Cole et al. 1986). An evaluation of tradeoffs between recreation and other project purposes is a necessary component of reservoir operations strategy. However, procedures are currently not available to measure the linkage between reservoir operations, fish community structure, and recreational use. Because of complex, but poorly understood, interactions among water, biology, and economic benefits, reservoir operators are unable to manage fishery resources on a system-wide scale (Cole et al. 1990). An examination of these interrelationships at CE reservoirs will provide opportunities for addressing public concerns regarding the effect of reservoir operations on aquatic habitat and recreational opportunities.

Objective

The objective of this proposed research is to determine relationships between reservoir operations and recreational use of fishery resources. In addition, operational strategies will be developed to maintain fishery resources while supporting other project purposes. The results of this work will support related research to develop improved natural resource valuation techniques by providing the linkage between project operations and natural resource/recreation conditions.

Approach

The initial effort of this research will be to classify CE reservoirs by the composition of the fish community, characteristics of the aquatic habitat, and the recreational use of the reservoir. Once this has been completed, representative reservoirs will be selected and case studies will be conducted to evaluate the effect of reservoir operations on the fishery and subsequent recreational use. The results of the classification and case studies will be used to develop operations criteria to evaluate and improve the recreational fishery in CE reservoirs, and develop fishery management procedures as part of reservoir operations.

Reservoir classification

Reservoirs will be classified according to biological, physical, chemical, and recreation information available from Federal and State resource agencies responsible for operating the reservoir or managing the fishery resource. The classification will be empirically derived to allow reservoir managers to stratify management programs

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by reservoir types (Dolman 1990). The most important aspect of the classification will be to identify how harvest of recreational fishes is influenced by project operations.

The information discussed below will be compiled for each reservoir and entered into a database. Multivariate statistical methods will then be used to develop a classification matrix, identify biotic and abiotic attributes that predict changes in the recreational fish community (Dolman 1990· Carline 1986), and evaluate relationships between project operations and harvest of recreational fishes.

a. Reservoirs will first be delineated according to their primary function such as hydropower, flood control, or navigation.

b. The fish community will be grouped according to taxonomic composition, trophic position, habitat use, or reproduction mode (Carline 1986). For example, Dolman (1990) came up with five dominant species assemblages in his classification of Texas reservoirs:

(1) Orangespotted sunfish.

(2) Red-breasted sunfish-green sunfish.

(3) Longear sunfish.

(4) Blue tilapia-threadfin shad.

(5) Redear sunfish.

Other groups commonly used include sport, commercial, and rough fishes.

c. Physical and chemical characteristics of each reservoir will be determined, including things such as reservoir age, drainage area, surface area, mean depth, outlet depth, temperature, pH, conductivity, turbidity, and other environmental variables related to project operations and habitat quality.

d. Recreational use information including harvest rates, season, and activity distribution and visitor origin data, where available, will be summarized for each project and included in the classification system. This information will serve as the basis for linking fish community structure to recreational use of fishery resources at classified reservoirs.

Case studies

Case studies at representative reservoirs will provide quantitative data to substantiate and illustrate linkages between project operations, fishery resources, and recreational use including harvest rates of sport fishes. The reservoir classification will be the basis of selecting representative reservoirs for more detailed studies. Initial consideration will be given to research and demonstration units when selecting case study sites. Criteria for minimizing detrimental effects of reservoir operations on natural resources and for improving fisheries and recreational use will be identified and demonstrated.

Discussion

Corps of Engineer reservoirs are operated primarily for hydroelectric generation, flood control, and navigation purposes. However, benefits derived from the recreational fishery can be substantial. Valuation studies that serve as the basis for determining trade-offs between operational alternatives require an understanding of linkages between project operations, fisheries, and recreational fishing. The results of this work will provide that linkage for the types of reservoirs included as case study sites.

The 1990 Water Resource Bill requires that any CE activity must consider the effect of operation and maintenance on wildlife and fishery resources. As the importance of fish and their habitat grows nationally, controversy over the effect of project operations on aquatic resources will intensify. Resolution of these controversies will only occur if relationships between recreational fisheries and project operations are clearly understood.

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Development of Wildlife Inventory Procedures for Corps Operations and Maintenance (O&M) Projects

by
Chester O. Martin[1]

Introduction

Most Corps of Engineers reservoir projects have active management programs for key wildlife species occurring on their lands. Species emphasized are traditionally game species, but many projects also manage for selected nongame species. Effective habitat management for both game and nongame animals requires a knowledge of the population status of those species on the parcel of land being managed. However, wildlife inventory data are often not available at Corps projects, even for major game species. One reason for this is that many of the standard techniques used in scientific studies are simply too costly and labor-intensive for practical application on project lands. Thus, there is a need to identify and evaluate survey techniques that are potentially feasible and repeatable at Corps Operations and Maintenance (O&M) projects.

Background

Census methods

Censusing free-roaming wild animal populations is often a difficult task and requires careful planning, preparation, and execution (the term "census" is used in this report to mean any count of animals made to estimate a population; it does not necessarily imply a total count per unit area). The census method chosen for a species or species group will be influenced by constraints of time and cost, objectives of the census, the desired level of accuracy and precision, and terrain and habitat features. The application and intensity of inventory techniques used on an area will be governed by the overall goals of the management program.

A variety of techniques have been developed to estimate wildlife populations, especially for popular game species (Overton 1971; Davis and Winstead 1980). For example, numerous methods have been used to census white-tailed deer (*Odocoileus virginianus*), and population estimates may be based on either direct or indirect counts. Direct methods involve actual visual counts of deer and include deer drives, Hahn cruise-lines, spotlight counts, aerial surveys, and daylight mobile counts (Beasom 1979; Teer 1984; Melchiors, Thackston, and Stobaugh 1985; Mitchell 1986a). Indirect counts may be obtained by enumerating deer signs and converting the results to an index, or by establishing a ratio within the population and expanding it to the total population. Indirect methods include sign counts such as pellet group surveys, track counts, trail counts, and browse surveys as well as population reconstruction from mark-recapture or harvest data (McCaffery 1976; Stormer et al. 1977; Mitchell 1986b).

Although density data are sometimes desirable, especially for intensive management programs, the methods required to obtain these data are usually expensive, difficult to implement, and labor-intensive. Thus, most of the techniques that may be realistically applied at Corps projects result in an index to the population size rather than an estimate of absolute density. Although indices are not generally capable of detecting subtle changes, they are useful for monitoring trends over time or for comparing relative abundance among populations (Wakeley, Roberts, and Martin 1990). By censusing the same areas over a period of years, it is usually possible to determine if populations are increasing, decreasing, or remaining stable.

[1] US Army Engineer Waterways Experiment Station, Vicksburg, MS.

Populations of most species are best monitored using a variety of methods. An integrated program using both census data and habitat-based methods will help the manager avoid the shortcomings of relying on a single technique to determine the status of his population. Available harvest data should also be obtained for species that are hunted or trapped on the area. This combination of information will allow the development of a broad-based data management system for each species.

Vicksburg District study

In FY89 the US Army Engineer Vicksburg District Operations Division contacted the Environmental Laboratory at the US Army Engineer Waterways Experiment Station (WES), and requested a survey of wildlife inventory procedures that could be used on their projects in Mississippi, Arkansas, and Louisiana. The study was needed because information on the population status of significant wildlife species was required to complete the project Operational Management Plans (OMPs), but adequate census data were not available for these projects.

A study was designed by WES and coordinated with personnel from the Vicksburg District and Lower Mississippi Valley Division. It involved the following major tasks: (a) District/Division coordination and selection of species to be surveyed; (b) literature review and assessment of methods used to inventory wildlife populations and evaluate habitat quality; (c) a pilot study to test procedures at Grenada Lake, Mississippi; and (d) development of instructional materials for training project personnel to implement wildlife inventories and interpret the results.

Eleven species were selected for population surveys to be conducted in the Grenada Lake pilot study. These were the bobwhite quail (*Colinus virginianus*), mourning dove (*Zenaida macroura*), eastern bluebird (*Sialia sialis*), mallard (*Anus platyrhynchos*), wood duck (*Aix sponsa*), bald eagle (*Haliaeetus leucocephalus*), eastern cottontail (*Sylvilagus floridanus*), gray squirrel (*Sciurus carolinensis*), fox squirrel (*S. niger*), gray fox (*Urocyon cinereoargenteus*), red fox (*Vulpes vulpes*), and white-tailed deer. The technical literature was reviewed to identify potential methods for censusing populations of the selected wildlife species (Table 1). An assessment was made of the reliability of each technique and of the time and effort required for implementation. Miscellaneous reports from State and Federal agencies were also reviewed, and government and university biologists with expertise in conducting population inventories were contacted for specific information. Available habitat-based methods were also examined.

After a thorough assessment of techniques, those determined to be most appropriate for Vicksburg District projects were selected for further evaluation. Major criteria for selection included accuracy, reliability, labor requirements, costs, and potential application on Corps lands.

Both WES and project personnel were involved in the selection of study sites for conducting surveys at Grenada Lake. Vegetation maps were examined for each compartment, and survey routes were distributed as equitably as possible throughout the project. However, poor road access and the fragmented nature of project lands limited sampling in some areas. Wildlife surveys were conducted in the following habitat types: pine forests, mixed woodlands, upland hardwoods, bottomland hardwoods, shrub flats, agricultural lands, pastureland, and old fields (Figure 1).

Techniques used for each species or species group were bobwhite (whistle count), mourning dove (call count), bluebird (breeding bird survey, modified), cottontail (roadside spotlight count), squirrels (time-area count), white-tailed deer (spotlight census), and foxes and other furbearers (scent station survey) (Figure 2). Inventories for eagles and waterfowl were not conducted as part of the field study, but available State and US Fish and Wildlife Service mid-winter survey data were analyzed. The Grenada Lake pilot study was conducted from December 1989 through September 1990.

The majority of techniques examined in the pilot study were designed to estimate the relative abundance of populations and resulted primarily in an index to population size. Although these are considered low-resolution techniques and are not generally capable of detecting subtle changes,

Table 1
Summary Listing of Potential Methods for Censusing Populations of Selected Wildlife Species

Bobwhite Quail	
Walk census	Roadside count
Strip census	Whistle count
Lincoln index	Habitat-based methods
Mourning Dove	
Call count	Habitat-based methods
Wild Turkey	
Mark-recapture techniques	Landowner/mail carrier surveys
Transect counts	Hen/poultry counts
Track counts	Gobbler counts
Habitat-based methods	Aerial surveys
Eastern bluebird	
Breeding bird survey	Plot method
Christmas bird count	Nest box surveys
Line-transect method	Habitat-based methods
Bald eagle	
Aerial surveys	Boat surveys
Road surveys	Habitat-based methods
Waterfowl	
Aerial surveys	Next box surveys
Float counts	Banding/harvest surveys
Roost counts	Habitat-based methods
Ground counts	
Eastern Cottontail	
Mark-recapture techniques	Roadside/spotlight counts
Drive count	Habitat-based methods
Pellet group counts	
Gray Squirrel and Fox Squirrel	
Mark-recapture techniques	Leaf nest counts
Trap-sight method	Habitat-based methods
Time-area count	
Gray Fox and Red Fox	
Mark-recapture technique	Scent station surveys
Aerial surveys	Hunter/harvest inoices
Den surveys	Predator calls
Tract and dropping counts	Habitat-based methods
White-Tailed Deer	
Hahn deer cruise	Pellet group counts
Drive counts	Mark-recapture techniques
Spotlight census	Harvest surveys
Track counts	Browse surveys
Aerial surveys	Habitat-based methods

they can be feasibly applied on project lands and provide biologists with useful information for developing habitat and population management strategies.

The final phase of the Vicksburg District study will be to conduct training for project personnel responsible for implementing wildlife management programs. A training notebook will be prepared on selected species (primarily those covered in the pilot study) and associated inventory techniques. Hands-on field exercises will be performed to demonstrate each method.

NRRP Study Plan

A study on wildlife inventory procedures is proposed as part of the US Army Corps of Engineers Natural Resources Research Program (NRRP). The basic concept, approach, and major tasks are described below.

Objectives

The major objective of the study will be to assess and demonstrate methods available for conducting wildlife inventories. Emphasis will be on evaluating and field-testing potentially reliable, cost-effective, and repeatable techniques that can be used to estimate populations of selected species or groups of species. The application of appropriate census procedures will result in baseline data that will allow project personnel to develop more successful wildlife and habitat management programs for their lands.

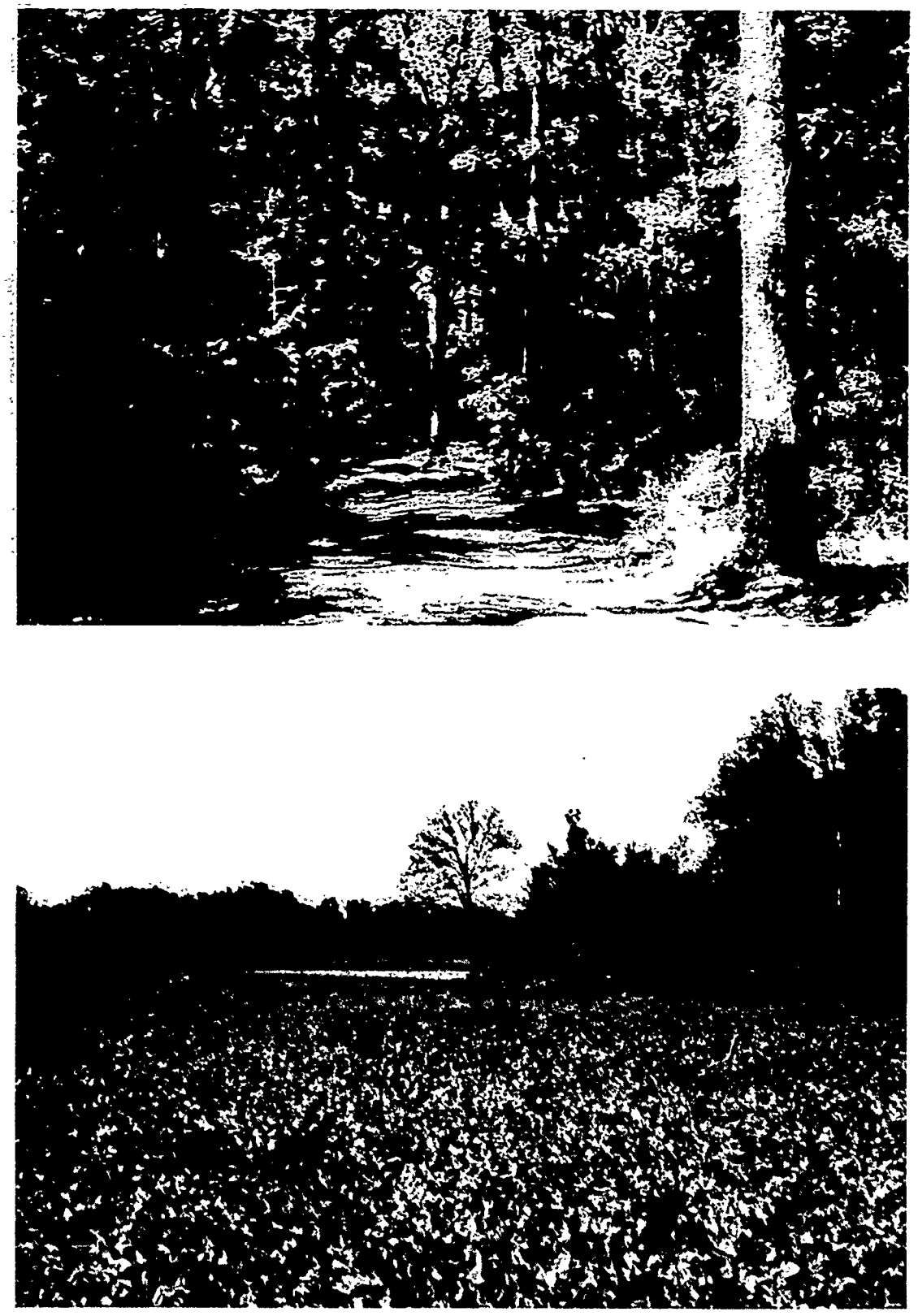

Figure 1. Wildlife surveys were conducted in forested, open (agricultural), and transitional habitats at Grenada Lake, Mississippi

Figure 2. Wes biologists and Grenada Lake rangers recording scent station data

Proposed work

The study will involve the following major tasks (a) Corps- wide coordination and selection of species for analysis of census techniques; (b) review and assessment of available methods used to census wildlife populations; (c) conduct of pilot studies to test methods regionally and in a variety of habitats; and (d) development of instructional materials on the application of inventory techniques and the analysis of census data.

Selection of species for analysis of census techniques will be determined through a Corps-wide survey of District and project personnel. A preliminary list of potential species will then be developed, and Corps personnel will be requested to rate those species considered to be most significant on their projects. Significance could be based on importance as a game animal, high public concern, perceived ecological value, or other criteria. Based on this response, a final set of species will be selected that represent an appropriate cross section of management needs throughout the Corps.

The scientific literature will be thoroughly reviewed to identify potential methods for censusing populations of selected species. For example, techniques known to be used for quail surveys include the walk census, strip census, line transect, Lincoln index, and whistle count (Rosene 1957; Norton et al. 1961; Dimmick, Kellogg, and Doster 1982; Guthery 1988; Kuvlesky, Koerth, and Silvy 1989). Each method will be scrutinized on the basis of accuracy, reliability, labor requirements, costs, and regional application on project lands. Much of the literature has already been assimilated for major game species in the Southeast through the efforts of the Vicksburg District study.

Pilot studies will be conducted regionally to further evaluate methods and to tailor procedures to Corps settings. This will result in the fine-tuning of methods and simplification of data collection and analysis. Pilot surveys should be run for a minimum of 2 years, and ideally for 3 years, to obtain an adequate data set for analysis and comparison among sites. The number of sample locations chosen for these surveys will depend on the level of funding.

Products

Technology transfer products resulting from the study will include WES technical reports, bulletin articles, and instructional materials for project personnel. Major products and milestones are itemized as follows:

a. Selection of species for analysis of methods.

b. Review of available census techniques.

c. Report on description and comparison of methods.

d. Regional pilot studies for selected species.

e. Data analysis and report on results of pilot studies.

f. Report on recommendation of techniques and guidelines for their application on Corps lands.

g. Self-instruction notebook on the application, analysis, and interpretation of census methods.

Discussion

Obtaining accurate estimates of wildlife populations is considered a major objective of most management programs (McCullough and Hirth 1988), and a knowledge of population size is critical for an understanding of biological parameters and processes within a management area (Novak et al. 1991). Unfortunately, estimating population size is rarely an easy or straightforward task due to limitations imposed by underlying assumptions of census techniques and/or the amount of data required for a reliable sample (Burnham, Anderson, and Laake 1980; Seber 1982; White et al. 1982; Wilson and Anderson 1985; Novak et al. 1991). Also, a number of theoretically sound estimation methods fail in practice because assumptions cannot be met or the criteria for application are too restricted to be achievable under field conditions (McCullough and Hirth 1988). Some methods, such as mark-recapture techniques, are simply not implementable under normal circumstances because of the high cost and effort required (Silvy, Hardin, and Klimstra 1977).

Most Corps of Engineers operational projects have active habitat management programs for key species of interest. However, efforts to collect population data are often minimal, and techniques used may be inconsistent among projects and survey periods. Reasons for this include (a) methods recommended by the scientific community are usually too expensive and time-consuming; (b) the fragmented nature of Corps project lands often makes it difficult to implement standard inventory techniques; (c) Corps rangers are responsible for a variety of tasks associated with project operation and seldom have adequate time to conduct routine wildlife inventories; (d) project personnel often do not have the background and training needed to design and conduct population surveys; (e) wildlife programs and studies are frequently of low priority at Corps projects; (f) many Districts and projects question their authority and/or obligation to conduct wildlife surveys, and (g) some Districts feel that they should rely entirely on State agencies for information on wildlife populations (even though the States rarely have the resources available to inventory wildlife populations on Corps lands). A combination of these factors has resulted in a general lack of information regarding the effects of habitat management on wildlife populations at Corps projects throughout the country.

Although many of the census techniques used in scientific studies are not feasible at Corps projects, there are a variety of available methods that can be used to monitor population trends over time or compare numbers among management units. The proper selection and application of techniques for key species or communities will result in an invaluable database that can be effectively used to help make habitat management and stewardship decisions. There is a need to examine potential census methods nationwide and develop guidelines for their application on project lands.

Acknowledgements

I wish to especially thank Ms. Julie Marcy and Mr. Grafton Anding, US Army Engineer Vicksburg District (CELMK-OD-M), for their support of this proposal and sponsorship of the District study on wildlife inventory methods.

Grenada Lake personnel who assisted with the District study were Ms. Melissa Miller and Messrs. Tom Norton, Don Gober, Billy Joe Upchurch, Hollis Ishee, John Hartley, Douglas Ingram, David Scobey, and Sam Marter. WES scientists who assisted with the District study and developed information summarized in this proposal were Drs. Thomas H. Roberts, Wilma A. Mitchell, and William P. Kuvlesky, Jr., and Messrs. Darrell E. Evans, Eric C. Pelren, and Kevin Grosz.

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Management of Water-Based Recreation Opportunities: First Year Status

by
John Titre[1]

Introduction

The purpose of this paper is to present the status of an ongoing work unit that began in FY91. Readers are advised to scan last year's proceedings for a complete explanation of the problem, its scope, and lessons learned from nearly a dozen Natural Resources Technical Support Program requests. Major accomplishments of FY91 are:

a. National Workshop held in Nashville, TN.

b. *RECNOTES* article announcing the research effort.

c. Study plan for achieving the study objective, which is

"To develop methods of establishing and maintaining high quality water-based recreation opportunities while responding to increasing use pressures."

At the close of the Nashville Workshop the word "establishing" was added since the participants felt that methods and criteria were in need of establishment before they could be applied and quality recreation maintained.

Water-Based Recreation

The focus of this work unit is on water-based recreation activities. There is an important distinction between water-based and water-related recreation. Water-based activities are dependent on the use of water for engagement in recreation. Obvious examples include boating, swimming, and fishing. Water-related activities are enhanced by their association with water but could take place in the absence of a water body. Upland game hunting, camping, and picnicking are examples of such activities. The emphasis of the work unit is limited to activities that depend on water, yet it is broader than just what occurs on the water body.

Corps Responsibility

This focus places greater emphasis on the Corps' responsibility to control how and where visitors gain access to Corps lakes nationwide for the purpose of recreation. The benefits visitors seek are important to the kind of product we deliver. Although the quality of their visit may mean different things to different people, this research effort assumes that loss of quality can be measured, and indicators can be identified to prescribe actions that will improve conditions. Improving conditions for quality environments and quality user experiences should be central to all carrying capacity evaluations. A model to illustrate the three influences on quality is shown in Figure 1.

Recreation Quality

A critical element in the Corps recreation program is the delivery of high quality experiences while reducing the burden on management. The following quote from a paper delivered at the Nashville Workshop by Mr. Roger Deitrick, Resource Manager, J. Percy Priest Lake illustrates the relationship between quality and management, although this particular example may have more in common with water-related conditions.

> The improper design of certain areas and facilities, as well as the heavy use, resulted in severe overcrowding, continual conflicts among users, and contributed to

[1] US Army Engineer Waterways Experiment Station, Vicksburg, MS.

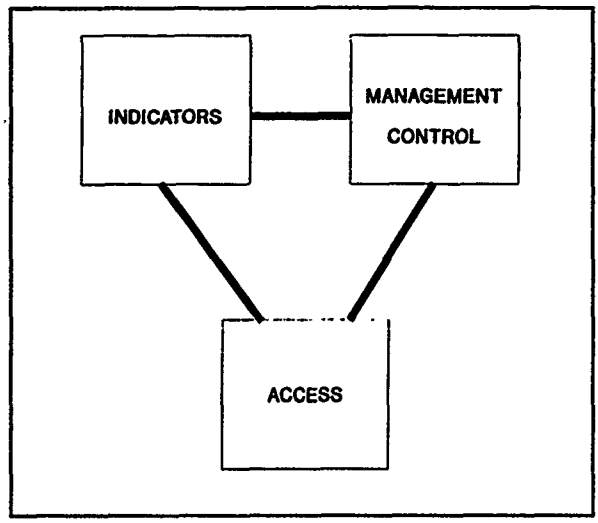

Figure 1. Quality influences model

several accidents. These all combined to provide a less-than-enjoyable recreation experience for the visitor and may also have contributed to the high rate of vandalism that was prevalent at the project over the years.

Obviously, the effects of overuse have placed a greater strain on already limited management resources. Resolving problems of carrying capacity before they become entrenched is expected to actually save time and dollars. The alternative strategy of reacting to use pressures on a case-by-case basis results in managerial chaos. New management strategies are emerging to suggest that managers be more proactive (Covey 1989, p 71). Proactive resource managers mold their environment more than they allow the environment to mold them. Providing quality recreation experiences becomes a conscious choice. In management circles, putting this choice to work is called "solution selling" (Covey 1989, p 75), which is in stark contrast to finding reasons why our organization cannot respond to the quality challenge. Managers like Roger Deitrick and his staff have accepted the responsibility to meet the quality challenge. The role of research in this process is to develop and test appropriate strategies necessary to assist managers with that job.

Just as we have made a serious organizational commitment to boating safety, a similar commitment is needed to maintain recreation quality. This requires asking questions about whether our visitors are enjoying themselves, which will in turn lead managers toward system adjustments that upgrade recreation opportunities, a major output of our program.

Problem Identification Workshop

A Corps-wide workshop was convened in Nashville, TN, 5-6 March to explore the problem of overuse from the perspective of field personnel. Other levels of the organization were also invited to provide an institutional context for addressing the problem. The construction of a marina is a good example of the need to incorporate the concerns of several levels within the Corps. The workshop was divided into four sessions to focus the material presented by the speakers into the following groups: (1) problems and issues, (2) opportunities and approaches, (3) institutional constraints, and (4) research. Nearly all 20 participants provided short talks during each morning of the 2-day workshop. Afternoons were spent in small group discussions on questions related to the morning talks. Papers provided by the speakers and summaries of the discussion sessions are found in the Study Plan (Titre 1991).

During the process of facilitating the workshop, researchers from the US Army Engineer Waterways Experiment Station (WES) and participants grouped the field study components into six problem/opportunity areas:

a. Defining quality.

b. Information and education.

c. Design considerations.

d. Decisionmaking flowchart.

e. Regional implications.

f. Special topics/field testing.

Field Studies

Field study components will be investigated using a case study or quasi-experimental research design. Case studies are in-depth investigations to take full advantage of situations where much

can be learned from existing approaches. This recognizes the extensive trial and error experiences of managers. The task of research and development is to document successes and failures for dissemination to other situations. As a clearinghouse, WES is well-suited to evaluate case study results and package the findings in a form appropriate for application. The actual writing of the gathered material will require the assistance of one or more field personnel stationed at WES for short periods of time. The mechanism to bring field people to WES is already in place. This supports a suggestion by Mr. Pete Milam (1990, p 9), Jacksonville District, to "adopt-a-practitioner." Milam also suggests that researchers get involved in field situations. Such cross-training would, in his opinion, allow both parties to

> learn to communicate in the "user's" language rather than the "researcher's" or the "practitioner's" language. This would help bring us back to the reality of the problem and as a result provide meaningful results.

Case studies are ideally suited for this type of R&D interchange.

Quasi-experimental research designs are more traditional with respect to social science. The aim here is to investigate cause-and-effect relationships by setting up conditions where the treatment varies (Kerlinger 1973, P 381). With the absence of a control plot as in the agricultural sciences, social scientists look for conditions that approximate a before-and-after treatment, since they are unable to manipulate behavior. The observed differences based on two conditions such as high and low density are documented, and reasons for the differences are identified. Care is taken to isolate any intervening influences that may contaminate a direct link between density and the variable of interest (e.g., satisfaction).

Locations for the field studies will be evaluated based on problem indicator criteria identified during the site reconnaissance task found in the Study Plan (Titre 1991). The intention is to identify projects that provide conditions useful for application nationwide. The Recreation Research and Demonstration Units (RRDU's) are an obvious starting point for candidate areas. The RRDU's represent a spectrum of project conditions and therefore deserve consideration. Other criteria also deserve consideration, such as pending expansion decisions, complaints about overuse, and conflict among users.

Technical and Instruction Report Preparation

If possible, findings from the separate field studies will be organized into individual field study reports. A series of reports has a number of advantages over one thick document. First, managers may only be interested in one topical area, such as design applications, and not the other studies. Second, authors will have greater flexibility in tailoring their report to the problem being investigated. And finally, report production will be quicker, to facilitate review and coordination. This allows the work unit to progress on schedule to meet critical milestones.

An instruction report will synthesize information from the field studies in a "how-to" manual. This will allow managers to decide which of the technical reports may be most appropriate to solving their particular problem. It also provides an overview of the process for senior level staff to visualize the "big picture." Field personnel can then use the technical reports and apply recommendations in greater detail. A full set of field studies and the instruction report should be provided to project offices for reference. As managers apply report applications, these experiences can also be documented and disseminated through regular publication channels established in the Natural Resources Research Program under the Environmental Resources Research and Assistance Program.

Since this research effort is intended to function as a manager-oriented process, little direct assistance from outside research personnel will be necessary unless suggested in report recommendations. However, it is anticipated that for more controversial and high-profile problems, outside studies may be advisable. Specialized training may also be in order to facilitate the sharing of experiences with specific applications. This prevents managers from re-inventing the wheel each time they tackle a new problem that someone else has encountered. It is envisioned

that the WES role would be to act as a clearinghouse of national experiences for organizing meetings, workshops, and other forums to transmit what has been learned from one location to another.

Summary

This paper sought to build on the experiences of the Corps-wide workshop on the management of water-based recreation opportunities. It also attempted to indicate the content and direction of the individual field studies. And it provided some thoughts on how this work unit will operate after it is complete, so that the results can continue to serve the intended beneficiaries: Corps managers and rangers.

This work unit is fortunate to arrive at a time when information from other research efforts can be utilized as needed to enhance its success. Our demonstration units, techniques for estimating use, the economic impacts of our projects, the regional demand for the opportunities we provide, the alternative fee programs that we can use as management tools, among others, have received logical development to permit ventures into direct management application. It is anticipated that as the research program continues to mature, greater benefits will be realized from the interdependence of ongoing work units as they strive to provide the assistance that managers need.

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A General Approach for Measuring the Effects of Alternative Fee Programs

by
R. Scott Jackson[1] *and H. Roger Hamilton*[1]

Background

The purpose of this paper is to describe prior recreation fee research and the general approach for a work unit in the Natural Resources Research Program that addresses the Corps of Engineers recreation fee program.

The Corps of Engineers has charged recreation use fees since the passage of the Land and Water Conservation Fund Act of 1965. During the early 1970's the Corps charged entrance fees for a brief period. This practice was soon discontinued in response to severe public opposition. Currently, legislative and administrative actions indicate a revival of interest in this topic. Where national policy on this issue is going and where it will end are uncertain. A recent study of the Corps of Engineers Recreation Program identified 16 fee program alternatives designed to raise revenues in order to reduce the Federal burden of providing recreation opportunities at Corps projects. The alternatives ranged from adjustments to existing fees to the introduction of fees for facilities and services previously provided without charge (Headquarters, US Army Corps of Engineers 1990).

Managers do not have adequate information on how visitors would respond to the wide variety of potential changes in recreation use fees. We do not know the potential effectiveness of various types of cost-recovery mechanisms, where they can be implemented, or what specific facilities and services can be feasibly addressed. Thus, the ability to predict the potential effectiveness of alternative recreation fee programs to achieve management objectives is limited.

Study Objective

The objective of this work unit is to identify and evaluate the potential effects of alternative recreation fee programs on recreation use patterns and revenues. The study will measure the extent to which visitors will accept increases in existing camping fees and the introduction of day-use fees for facilities currently offered. In addition, the study will identify the demand for additional facilities and services, and the fees current users would be willing to pay for these additional amenities.

Related Studies

Many studies show that the public is willing to pay reasonable fees for recreation opportunities, particularly if the fees are directed toward recovering the cost of providing the recreation facilities and services (Economic Research Associates 1976; Manning et al. 1984). One important issue that needs to be addressed is the extent to which raising existing fees or imposing new recreation use fees might discriminate against low-income segments of society (Howard 1986). Studies have shown that most resource-based recreation facilities have disproportionately low user representation from low-income people (Vaux 1975; Lucas 1980). However, the close proximity of Corps of Engineers projects to major urban areas may make them more accessible to low-income populations than more remote national parks and wilderness areas. Verberg (1975) found that fees resulted in inequities to certain social groups. Some lower income groups were barred from participating in recreation at

[1] US Army Engineer Waterways Experiment Station, Vicksburg, MS.

specialized sites that required payment of a fee. This argument of impacting low-income populations is countered by the results of a 1976 survey by Economic Research Associates that found that although a majority of all groups favored pay-as-you-go recreation funding, more of those in low-income, elderly, and rural groups favored it than did respondents in young, higher income, and college-educated groups (Driver and Harris 1987).

Historically, public recreation programs have been heavily subsidized by tax revenue. In 1990, less than 10 percent of the Corps' recreation operating costs were recovered through recreation use fees. Revenues of the National Park Service in 1981 accounted for only 2 percent of operations and maintenance costs (US General Accounting Office 1982). Surveys show that state park systems recover only 30 to 41 percent of their operational costs from user fees (Manning et al. 1984). This pattern of supporting recreation programs at least in part through tax revenues continues to be endorsed by the public (Driver, Bossi, and Cordell 1985). The question is to what extent visitors should support recreation programs through direct use fees.

The institution of recreation fees is usually justified to recover operating costs. However, additional benefits may be realized by recreation fee programs. Advocates of fee programs cite benefits including improved quality of recreation opportunities, reduced congestion from redistribution of use, and program stability (Driver and Harris 1987).

General Study Approach

The implementation of changes in the Corps of Engineers recreation fee program, particularly the introduction of day-use fees, may require adjustments in operational procedures, changes in the physical layout of many recreation areas, and increased control of vehicular and pedestrian access. While these requirements exist, this work unit is not designed to address these considerations.

Of equal importance is the need to develop the capability to predict how recreation use patterns would change under alternative recreation fee scenarios. This can ensure that fee programs are adopted that have acceptable impacts on recreation use of Corps projects. The following is a listing of the typical types of questions that could be addressed by this work unit:

a. How will visitors respond to the initiation of day-use fees?

b. If offered a choice, at what price differential will visitors tend to choose to purchase annual permits instead of day passes?

c. What types of recreation areas, facilities, and services will visitors be willing to pay for to engage in day-use activities?

d. Will visitation decline and, if so, to what extent, if day-use fees are introduced?

e. Will low-income populations be disproportionately affected if day-use fees are imposed?

f. What additional facilities and services beyond those traditionally provided by the Corps would visitors be willing to pay for?

g. What effects do differential camping fees have on revenue and site usage?

To achieve the previously described work unit objectives and to answer the types of questions identified, personal interview surveys will be conducted of current users at representative projects. Study sites will be selected from among the Research and Demonstration Units throughout the United States. The survey results will be analyzed to identify similarities and differences between user groups in how they will react to recreation fee initiatives. Revenue projections and recommendations on the criteria for recreation areas to be included in the fee program will be able to be developed based on the results of this research.

Conclusions

Past recreation fee research has addressed impacts of fees on user populations and the linkage

between fees and management activities. This work unit will extend previous research and identify impacts specific to populations served by Corps of Engineer projects. The results of this work will improve a manager's ability to anticipate how recreation use will change with changes in use fees in order to plan management actions that address future conditions.

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Division, District, and Project Breakout Session

by
Sherman Gee, Moderator[1]

The breakout session was held without US Army Engineer Waterways Experiment Station (WES) personnel present and focused on (a) the proposed new work units, and (b) current concerns with the Natural Resources Research Program. Sherman Gee served as facilitator and reported the group's discussion to the full program review group the next day. Pat Docherty served as the recorder.

Comments on Work Units

Research Unit 375-1. ***Measuring economic impacts of dispersed recreation.*** This work unit is very well supported by the Field Review Group. Some concerns were expressed over the need to identify specific user groups: i.e., hunters, fishermen, homeowners, etc. Also, statements were made that adjacent property owners request changes on project land in order to enhance their own property values, i.e., cutting of trees to improve a view of the lake. They often perform these types of actions illegally because their property values will improve more than any fine levied. These improvements could make a $10,000 to $20,000 difference in property values.

Research Unit 375-2. ***Impacts of US Army Corps of Engineers (CE) project on local real estate taxes.*** There was a great deal of discussion on how this information would be used. Some individuals were concerned that by providing this type of information and research methodology, it could be used against our resource management program, i.e., revenues. This information could be used to dismantle shoreline management. Other individuals objected to the word taxes being included in the title of the research proposal. They felt it had a negative connotation because of public outcry against taxes in their home Districts. Some participants felt this would be very good information to have to counter arguments that our projects take money out of the local tax base. Others were concerned that the scope of the study needed to be more clearly defined. For example, some projects exert property tax influence 30-40 miles away. Are adjacent landowners just the ones that border Federal property? There may also be other factors, besides the presence of our projects, affecting property values. How narrow or wide of a perspective do we need? Some discussion centered around whether or not we actually needed the information, or just the methodology to collect it. The final consensus was that it would be a difficult study to conduct, but it would be more beneficial to do it than not to do it. The comment that the results of the study could be a "double-edged sword" are very true.

Research Unit 375-3. ***Reservoir operations effect on fishery-derived economics.*** There was some confusion over whether or not this unit would include only fish that reside and spawn in the reservoirs. Most felt that the study should be limited to warm water fish in reservoirs. Some felt that it was essential to gather this type of information because we were actually getting sued for not having it! Others believed this type of research was suitably performed by our State partners. Some suggested that the work could possibly be cost-shared with the States. One commented that the work unit was misleading - it needed more focus on the actual economic value of recreational fishing. Others took the opposite view. Generally the work unit was well-supported by the group.

Research Unit 375-4. ***Development of wildlife inventory procedures for projects.*** Questions were raised about why the States are not already performing these types of samples. Others were concerned that we should be worried about the quality of habitat and not necessarily about the

[1] US Army Engineer Division, Ohio River, Cincinnati, OH.

number of animals. Some felt it should be an option for individual Districts and Divisions, and funded on a cost-reimbursable basis. Others would have rather seen something similar to what was proposed in the fishery study, i.e., what impact does the operation of our reservoirs have on wildlife populations?

General Comments

There still is a general perception that a better way to submit and review research units needs to be developed. Communications among Field Review group members should be more frequent than once a year. One suggestion was to reinstate the fall meeting or set up a teleconference system. Although the fall meeting could be desirable, the availability of travel funds would keep some from attending. The proceedings from this meeting took too long to get distributed. Someone recommended that a tear-off sheet in *RECNOTES* would be a good way to submit proposals. The bottom line was to do something, and that includes Field Review group members and not just the Tech Monitors or WES.

Should the Natural Resources Field Review Group be proposing research which basically involves environmental issues instead of recreation issues? Protecting the environment and responding to various Hazardous and Toxic Waste (HTW) requirements have begun to occupy a significant amount of staff time. Other field review groups may be performing these types of environmental evaluations. Is any of this information being shared? In short, we need a reading on what other field review groups are looking at and how their research may impact ours. Many of the pressing issues confronting our managers today relate to how we react to environmental concerns.

Should the Recreation Research Task Force be revived in order to flush out new viable research topics? A goal not yet achieved is to obtain needed research suggested by managers to assist them in making management decisions. Task force members present expressed feelings of both frustration and accomplishment. Local issues and policy requests seemed to dominate the input from the task force surveys without raising many issues of national concern which were researchable. Headquarters, US Army Corps of Engineers (HQUSACE) will evaluate this proposal and other suggestions offered.

Recent Developments in Campground Receipt Study Data Collection

by
Tere A. DeMoss[1]

Introduction

The purpose of this paper is to describe the status of an ongoing longitudinal study that has gathered descriptive statistics on camping from representative Corps projects. This paper covers three areas of that effort: (a) a description of the Recreation Research and Demonstration System (RRDS), (b) an outline of the study's procedural development, and (c) a discussion of innovations in the data analysis in the 1989 report and the Automated Use Permit System (AUPS) that was both efficient and useful for decision-making.

Recreation Research and Demonstration System

The RRDS was established in 1978, for the purpose of systematically gathering information on recreation and resource aspects of lake management from permanently designated outdoor laboratories. In constructing a representative sample of sites, Title V economic development and physiographic regions were combined to produce 30 physioeconomic regions. Twenty-four units were selected from these regions, representing approximately 5 percent of the then 45 Corps projects. The projects were chosen to characterize multipurpose reservoirs, locks and dams, and dry lakes. Specific criteria for selection were as follows:

a. Full range of activities.

b. Spectrum of resource characteristics.

c. Distribution of units nationwide.

d. Range of conditions at multiple-purpose projects.

e. Typical planning, design, and management tasks.

A US Army Engineer Waterways Experiment Station publication (Hart 1981) shows the distribution of the sites across the United States and contains more information about the RRDS units and their selection.

Campground Receipt Study

One research effort that uses the RRDS is the Campground Receipt Study (CRS). Through the CRS, a database has been developed on one of the Corps' most popular activities: camping. The CRS has undergone continual development and evolution since the study program began. Data gathered at the demonstration units have undergone three distinct phases of development (Figure 1). Initially, the study's attention focused on the campground receipt in terms of defining how and what types of data were collected. Forms were improved and finalized during the early part of the study. Comparison of key variables across projects has provided an assessment of campground market behavior in the Corps. Variables that have been measured include parties with prior visits to the project; camping parties with the project as their primary destination; camping parties that have Golden Age passports; and camping parties with vans, cars, motor homes, trucks, tents, pop-up trailers, pickup campers, travel trailers, and powerboats.

A second stage has been the documentation of general results over time, such as the types of camping equipment. Important trends are highlighted in a series of reports (e.g., an increase in camping parties with tents and camping parties

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SYSTEM DEVELOPMENT

1981 Report	Development of Data Collection Procedures	---	---
1982 Report	Discussion of Potential Uses	---	---
1983 Report	Forms Evaluated and improved	Key variables reported	---
1984 Report	Form Finalized	Broad Trends Identified	Initial applications
1985 Report	---	Trends extended	Visitor origin
1986 Report	---	Trends extended and evaluated	Project user profiles
1988 Report	Develop AUPS/CRS interface	Trends extended including Golden Age Variation	Microcomputer analysis packages developed
1989 Report	---	Trends reporting format changed	Revenue generated per site Occupancy Rates and Visitor origin(all sites) Revised summary report Format

Figure 1. A diagram of the system development of the Campground Receipt Study

with powerboats during the years 1981 through 1984)(Lawrence and Fritschen 1986).

The third stage of CRS development has included the use of data for analyses beyond routine summaries and toward the specialized application of the CRS data. Occupancy rates have been used as key indicators of economic viability in the hotel-motel industry for some time. They were also used successfully to reveal a decline of 19 percent in average daily occupancy rates for nationwide camping during the 1978 fuel shortage (LaPage and Cormier 1979). This contrasted with prior studies stating that gas availability did not affect camping trip plans. This decline was greatest in the western region of the United States. Regional differences were also evident in response to gasoline shortages.

Innovative Changes in the Data Analysis

The 1989 CRS report is the ninth in a series of reports which summarize the results of CRS. A few changes have been made to enhance readability. This report will include all the analysis of key variables summaries and trend analysis of the previous reports through 1988, with the addition of some improved data analysis. The trend analysis charts have been rotated horizontally with the value of each bar printed to the right of the bar. Also, the individual campground reports (located in the Appendix) have been reformatted from two pages to a single page.

This report will now include the yearly occupancy rate for each project (broken down to describe each individual campground). A calendar format has been used to illustrate the daily occupancy rate for each specific campground. A calendar was produced for each campground, included in Appendix B, for the month of July (Figure 2). The month of July was arbitrarily picked because of the 4th of July holiday. Also, the revenue paid per campsite is reported for each campground and can be compared to the occupancy rate for each project in Figure 3. A ZIP CODE analysis for each project shows the origin of visitors. This data can be used to prepare marketing information for each District (Figure 4).

CRS Data Entry and Output

The recent availability of computer technology at the field level has dramatically changed the possibilities regarding data entry and retrieval

Shelbyville Lake, Coon Creek, Occupancy Rates,[1] July 1989						
S	M	T	W	T	F	S
						1 44.80
2 24.89	3 19.00	4 5.88	5 3.62	6 2.71	7 1.81	8 1.36
9 0.90	10 0.90	11 1.81	12 1.36	13 1.81	14 3.62	15 8.14
16 22.17	17 42.08	18 41.18	19 39.82	20 46.15	21 69.68	22 75.11
23 27.15	24 27.15	25 32.58	26 35.75	27 43.89	28 83.71	29 80.09
30 4.52	31 7.69					
Occupancy Rate for Month 22.4 Occupancy Rate for Weekend during Month 39.0 Occupancy Rate for Weekdays during Month 15.3						
[1] The occupancy rate was calculated by the number of permits divided by (the number of calendar nights multiplied by the number of campsites).						

Figure 2. The daily and monthly occupancy rates from the 1989 CRS report

Project	Average Fee Paid per Site[1]	Occupancy Rate
Barkley Lake	396.49	22.1
Greer Ferry Lake	160.26	17.4
Hartwell Lake	187.03	11.5
Mississippi Pool 16	247.06	26.4
Oahe Lake	67.01	21.1
Ouachita Lake	283.66	49.2
Shelbyville Lake	348.22	26.1
Shenango River Lake	163.96	16.5
West Point Lake	226.51	10.5
[1] The average revenue collected per campsite is the total revenue collected at each project divided by the number of campsites at that project.		

Figure 3. Average revenue collected per campsite for 1989 CRS Projects

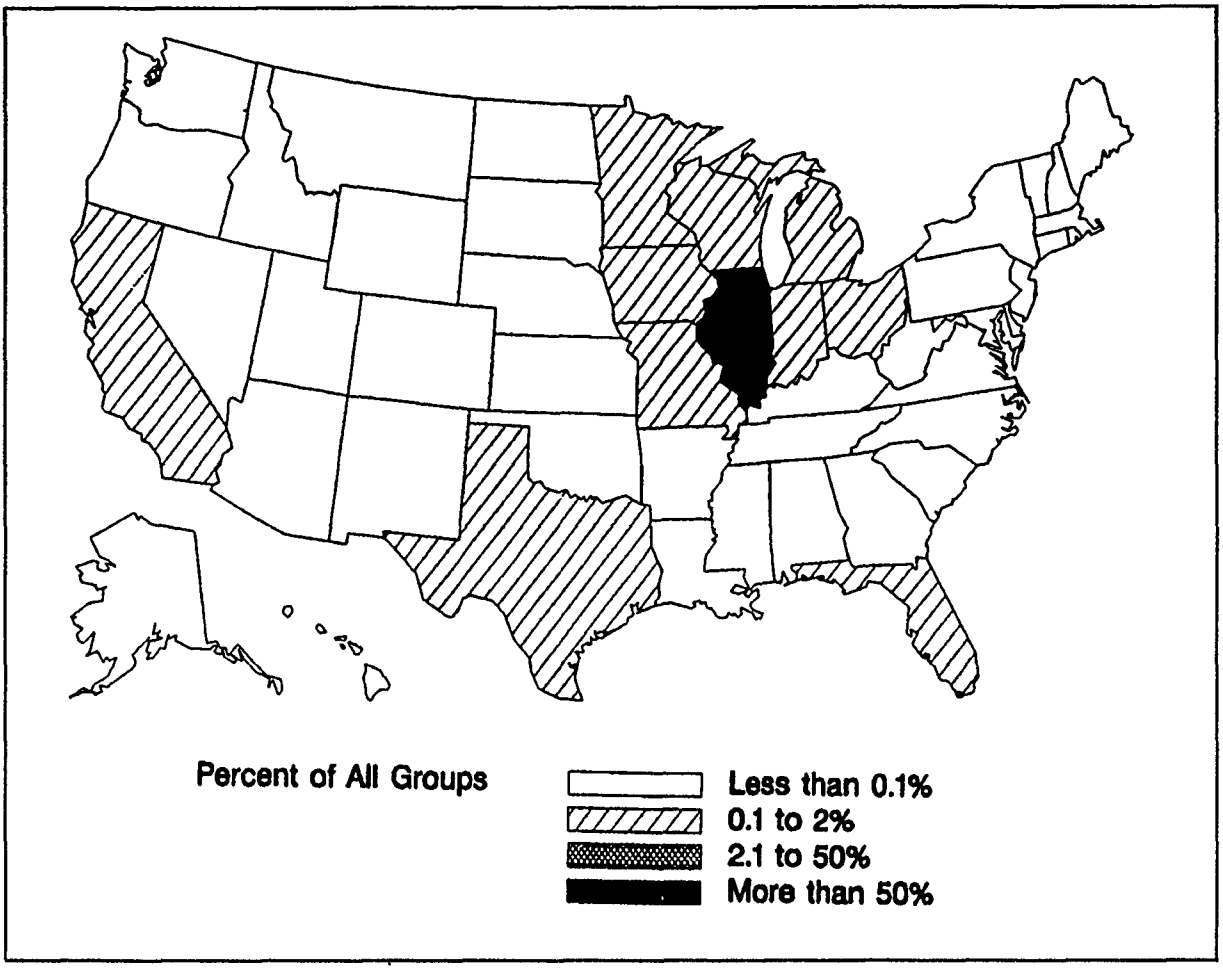

Figure 4. Percent of camping groups, by state, for Shelbyville Lake, 1989

for analysis and reporting of campground information. The development of the AUPS (Fritschen 1988) is an advancement in the direction of computer-aided management information systems. The AUPS was designed to incorporate the data requirements of the CRS so that any Corps project utilizing AUPS can collect CRS data. CRS-related questions are displayed by AUPS according to whether a program "switch" is set. This capability eliminates the time spent in entering the data later and provides some on-site data analysis capability.

Currently, field-level personnel can use dBase software to generate reports on variables such as site occupancy, average length of stay, ZIP CODES, average group size, and number of Golden Age permit holders. AUPS provides data that managers can review to resolve problems in a timely manner.

Summary and Conclusions

Investment in the CRS effort is beginning to reap the dividends of continual development. Nearly 10 years of data collection has permitted the examination of relationships between variables such as user fees and the amount of use. An earlier discussion in this paper established the importance of ongoing measurement for key variables to permit the interpretation of trends. This must remain the mainstay of the CRS effort. The campground information gathering system (CRS), aided by an information management system (AUPS), is approaching a situation in which project managers and District personnel can make decisions rapidly that reflect on-the-ground changes in the user of Corps areas. This AUPS/CRS combined system has been shown to improve overall efficiency and can benefit overall trend

analysis by enabling the publication of reports on a more timely basis.

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Estimating Dispersed Recreation Use in Multiple-Access Settings

by
Kathy King Mengak[1] *and M. Kathleen Perales*[2]

Introduction

In order to make informed planning and management decisions, resource managers need accurate information regarding the amount, type, and distribution of recreation use on their lands. This information is often essential for determining such things as facility and road construction, redistribution of use pressures, and allocation of personnel and money. In addition, government agencies are placing more emphasis on obtaining accurate visitation figures from their sites.

While use estimation techniques for developed areas such as campgrounds, swimming areas, and picnic grounds exist, those from the low-density or dispersed-use areas are limited. Dispersed recreation can be defined as "those forest, range, and desert-oriented recreation activities that normally take place outside of sites or areas that are developed or managed to concentrate recreational use" (Shafler and Lucas 1978). Estimating a park's dispersed recreation use can be difficult since this type of use is usually thinly scattered over large expanses of land and water and use is highly mobile and constantly in flux (James 1971).

Previous techniques have estimated visitation in dispersed use settings by identifying visitors as they enter or exit a roadway (Cushwa and McGinnes 1964), a trailhead (Lucas, Schreuder and James 1971; Leatherberry and Lime 1980), a launch site (James, Wingle and Griggs 1971), or as they pass a given segment of waterway (Marnell 1977). In these studies, access to the dispersed use areas is limited. Well-defined accesses, such as trailheads, channel visitors through a controllable entrance or exit, which aids in estimating visitor use.

In some dispersed-use settings, access to the resource is not limited, thereby making use estimation more difficult. Examples of these types of multiple-access areas would be large public lakes and reservoirs. These areas usually have a narrow band of shoreline around a body of water and parcels of land managed for low-density recreation or wildlife. Usually a number of paved roads and jeep trails crisscross the area, allowing visitors to park their vehicles in a variety of places such as roadsides, ends of bridges, small parking areas, and ends of roads. Once access to these lands is obtained, recreation use is not limited to these areas and can easily extend to the water resource.

The purpose of this paper is to outline a technique that was developed to estimate visitation at Corps of Engineers (CE) dispersed recreation settings with multiple access points. From the Corps perspective, it was essential that any visitor estimation technique satisfy the following four criteria:

a. Be standardized for widespread use, but adaptable enough to accommodate a variety of areas. (The CE manages about 472 projects.)

b. Integrate well with existing use-estimation techniques for developed areas such as campgrounds and swimming beaches to avoid double counting.

c. Meet reporting requirements that specify use in terms of visitor hours (a visitor hour is defined as the presence of one or more persons on an area of land or water resources for the purpose of engaging in one or more recreation activ-

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activities during continuous, intermittent, or simultaneous periods of time aggregating 60 minutes.)

d. Possess a mechanism for periodically updating visitation figures.

The test site for this procedure was John H. Kerr Reservoir, which is located in the Piedmont region along the border of Virginia and North Carolina. The project encompasses approximately 100,000 acres of land and water and supports significant levels of dispersed recreation use.

Methods

In studying dispersed-use settings with multiple access points and fluctuating use patterns, it became readily apparent that covering all possible access points or trying to locate recreators in the field would be extremely difficult. Therefore, it was decided that finding the recreators parked vehicle would be the most reasonable means of identifying use in an area. It was proposed that a combination of mail-back surveys placed on the recreator's vehicle and car counts be used. Returned surveys would provide information on the number of people per vehicle, visitor's length of stay, type of recreational pursuits, and other information of interest. The vehicle counts conducted by surveyors would provide the total number of vehicles in an area during a specified time. Visitation figures could be generated by correlating these two sources of information and then expanding the estimate to the entire area. The six-step procedure used at John H. Kerr Reservoir to accomplish this task follows:

a. **Defining dispersed-use seasons.** Since the amount and type of dispersed recreation use differs throughout the year, the first step is for knowledgeable project personnel to group significant use patterns into "seasons." At Kerr, these "seasons" were not based solely on seasons of the year (i.e., spring, summer) but also reflected various hunting and fishing seasons (i.e., fall deer/turkey hunting season and spring turkey hunting season). It should be emphasized that other dispersed uses could take place during these seasons but these were believed to remain constant or were negligible in extent. Also due to time and budget constraints, the Kerr study was limited to October 1986 through May 1987 despite the year-round occurrence of dispersed recreation use.

b. **Designating the dispersed-use areas and mapping the road network.** The second step was to identify all of Kerr's dispersed-use areas. These areas lay outside developed project lands that are monitored by traffic counters or other means of determining use. Based on aerial photographs and project personnel knowledge, Kerr was divided into 10 dispersed-use sampling areas. Whenever possible, these areas were divided at county and State boundaries, which proved to be useful since hunting seasons varied by State and county. Since an extensive road network traversed the areas, all roadways and jeep trails that visitors might use were identified and marked. Checkpoints, such as ends of roads, roadsides, and bridge crossings where users parked and dispersed to recreate were likewise identified. Each of the 10 areas and their associated checkpoints were designed to be patrolled in 2-hr to 3-hr intervals over a survey day. Based on past research of visitor length of stay, this would capture most recreators.

c. **Preparing a sampling plan.** Sampling was conducted using a stratified random sampling approach. Potential sample days (N) from October to May were stratified into nine nonoverlapping strata based on expected similarities in dispersed recreation use. Strata were based on a combination of hunting and fishing seasons and days of the week as follows:

Strata 1	Saturdays/holidays/opening days during fall deer/turkey season (N =134)
Strata 2	Weekdays during fall deer/turkey season (N =421)
Strata 3	Sundays during fall deer/turkey season (N =110)
Strata 4	Saturdays/Sundays after hunting season (N =260)
Strata 5	Weekdays after hunting season (N = 700)
Strata 6	Saturdays/opening days during spring turkey season (N =57)
Strata 7	Weekdays during spring turkey season (N = 235)
Strata 8	Saturdays/Sundays after spring turkey season (N =103)
Strata 9	Weekdays after spring turkey season (N =120)

A simple random sample of the resulting sampling units in each strata was then taken. The number of sample units chosen from each strata were determined by an optimal allocation process.

d. **Conducting the survey.** Researchers, with the help of project personnel, designed a survey appropriate for Kerr Reservoir. On the specified sampling day, surveyors drove through the designated area on a continuous and regular basis from sunrise to sunset completing each round every 2 to 3 hours. Whenever parked vehicles were encountered at or near designated checkpoints, a survey was left on the driver's door handle. Each survey was numbered and pre-stamped so it could easily be returned by mail or by the readily available drop boxes. Observational data such as vehicle type, license number, and educated guesses about the number of recreators per vehicle and their activities were recorded on data sheets. Vehicle description and license numbers were used to ensure that vehicles were not surveyed twice in a given day.

e. **Analyzing the data.** Survey and data sheet data were entered into a database management system and analyzed using a computer package called SAS (Statistical Analysis System) and Lotus 123. Of chief interest were visitation estimates from each strata that were totaled to yield project estimates for the study period. Other information such as recreational activities, distance traveled from vehicles, perceptions of land ownership, and hometown information were also analyzed.

f. **Monitoring future use.** In order to estimate future recreation use, load factors generated from survey information will be applied to periodic vehicle counts of the recreation areas.

Results

A total of 1,753 surveys were given out to visitors during the study period from October 1986 to May 1987. Since the recreator's name and address were unknown, no follow-up reminders could be sent. Of the surveys given out, 535 surveys were returned, for an overall response rate of 30.5 percent. Most of the surveys were returned by mail (80 percent) although drop boxes were often available in the dispersed-use areas where visitors parked. These boxes were used more frequently at the beginning of the study than towards the end. Reduced use of the drop boxes could be traced to vandalism and problems revolving around the maintenance and transport of the boxes.

Kerr's recreators were largely day-users (98 percent) that came from the six counties surrounding the lake. Although hunting was believed to be the primary dispersed-use activity, it was found that fishermen were actually more prevalent. Table 1 illustrates how the various recreational activities were distributed over the nine strata. As shown, hunting was largely a fall activity while fishing picked up in the spring. Walking was the next-most-popular activity (8 percent of respondents) followed by picnicking, boating, nature study and collecting.

Table 1
Number of Parties Participating in Each Activity, by Strata

Strata		Number of Parties Participating in Each Activity									
		Fishing	Hunting	Walking	Picknicking	Boating	Nature Study	Collecting	Hiking	Trapping	Other Activity
1	Sat./Holidays;Fall Deer/Turkey Season	21	106	10	4	2	5	–	2	1	5
2	Weekdays; Fall Deer/Turkey Season	22	51	4	–	3	2	3	1	–	5
3	Sundays; Fall Deer/ Turkey Season	3	1	3	–	1	–	1	–	–	1
4	Sat./Sundays; No Hunt	44	3	3	–	4	2	4	–	–	4
5	Weekdays;No Hunt	8	3	–	1	–	1	1	1	–	2
6	Sat./Opening Day; Spring Turkey Season	68	2	6	4	5	1	1	3	–	0
7	Weekdays; Spring Turkey Season	61	6	5	4	5	2	2	–	–	3
8	Sat./Sunday; No Hunt	36	–	8	4	1	2	3	1	–	8
9	Weekdays; No Hunt	27	2	4	2	–	2	–	1	–	0
All Strata		290	174	48	23	21	17	17	6	1	29

"Other" activities included such things as sighting in rifles, bait fishing, sunbathing, and off-road vehicles.

Visitors spent 4.3 hr on the average recreating at Kerr's dispersed-use areas, although 2 hr was the most common length of stay. Roughly 13.8 vehicles were found in each sampling unit (i.e., any possible sampling area on any possible sample day). Each vehicle contained approximately 1.69 persons. When asked how far they dispersed from their cars to recreate, many of the respondents (47 percent) reported traveling less than 0.2 of a mile, although there were a number of visitors (28 percent) that traveled over a mile from their vehicles. Most of these long-distance travelers were either hunters or fishermen using boats. In comparing the first two strata, which were composed largely of hunters, persons recreating on weekends/opening hunting days (strata 1) were more likely to disperse farther from their cars than those recreating on traditional weekdays (strata 2). Also, fishermen tended to stay closer to their vehicles than hunters, unless they had a boat with which to disperse.

In looking at when respondents arrived at the lake, a peak was noticed around 7:00 to 8:00 in the morning with a drop-off around noon and a smaller resurgence of arrivals in early afternoon

(Figure 1). Hunters differed slightly from this pattern in that most came before noon with few arriving after lunch. In the winter season (stratas 4 and 5), the peak arrival time occurred shortly after lunch, probably corresponding to warmer afternoon temperatures.

Departure times of visitors from the lake showed a peak just prior to noon, with a larger peak around 4:00 to 5:00 in the afternoon (Figure 1). Figure 2 shows the total number of parties that recreated in dispersed areas during each daylight hour. This total use of dispersed areas peaks between 10:00 and 11:00 in the morning and remains high in early afternoon.

Visitation estimates were obtained using the following formula:

Total Visitor Hours per Strata	=	Total # Rec. Veh. per Strata	•	Mean # Persons per Vehicle	•	Mean Length-of-Stay per Person

In this formula, the total number of recreation vehicles was obtained from the data sheets recorded by surveyors. The mean number of vehicles counted in each sample unit was multiplied by the total number of available sampling units within that strata. In order to reflect only vehicles containing recreators, a slight adjustment to the estimate was calculated. The mean number of recreators per vehicle and length of stay were calculated from responses to survey questions.

Once visitation rates for each strata were calculated, the figures for each strata were added together to obtain the project-wide visitation estimate for the study period. It was estimated that Kerr received 262,952.7 visitor hours of use during the 8-month study.

Conclusions

Little was known about the amount and nature of dispersed recreation use on lands with multiple access points. The technique outlined in this paper effectively captured a mobile, fluctuating group of recreators by targeting their parked vehicles. Observational data taken by surveyors was correlated with data from returned mail-back surveys left on the recreator's vehicle. Estimates of project-wide visitation for the 8-month period were obtained for reporting purposes. Rather than guesses of use, resource managers now have accurate estimates of visitation and can plan for and manage their dispersed areas accordingly.

While estimates of dispersed recreation use were obtained, several cautions should be stated. The first caution concerns trying to obtain specific site information from the estimates. The survey strategy used did not sample extensively enough in any given area to draw any specific conclusions about its amount and type of use. This technique is geared toward project-wide visitation only.

Second, seasons and strata for this technique must be carefully selected. At Kerr, winter stratas 4 and 5 may have extended too far into the warm weather of March and April and the onset of spring fishing, since visitation picked up dramatically during this time. Since a basic assumption in Kerr's stratification was that each of the nine strata exhibit a similar type and level of recreational use, this flux of use created more variability within the strata than was desirable.

A final caution involves use of this technique at other dispersed recreation areas with multiple access points. Due to the variety of potential sites and type of use, this technique should serve as a guide only with realization that certain adaptations may need to be made in order to accommodate the individuality of the site.

In addition to use estimates, this study also provided valuable insights into the dispersed recreation user. Resource managers at Kerr were interested to find out that while more vocal, hunters were not the largest group of dispersed recreators on the lake. While it is often true that the squeaky wheel gets the grease, perhaps informed resource managers will be more attuned to the needs of its anglers and other identified recreators. Knowing when recreators characteristically use dispersed areas could also be useful to managers. During busy seasons and daily peaks of use, managers may wish to concentrate additional ranger patrols if necessary.

In the future, it is hoped that an entire year of data will be obtained from Kerr Reservoir or some other site so that yearly use patterns can be examined. Also more work should be done on

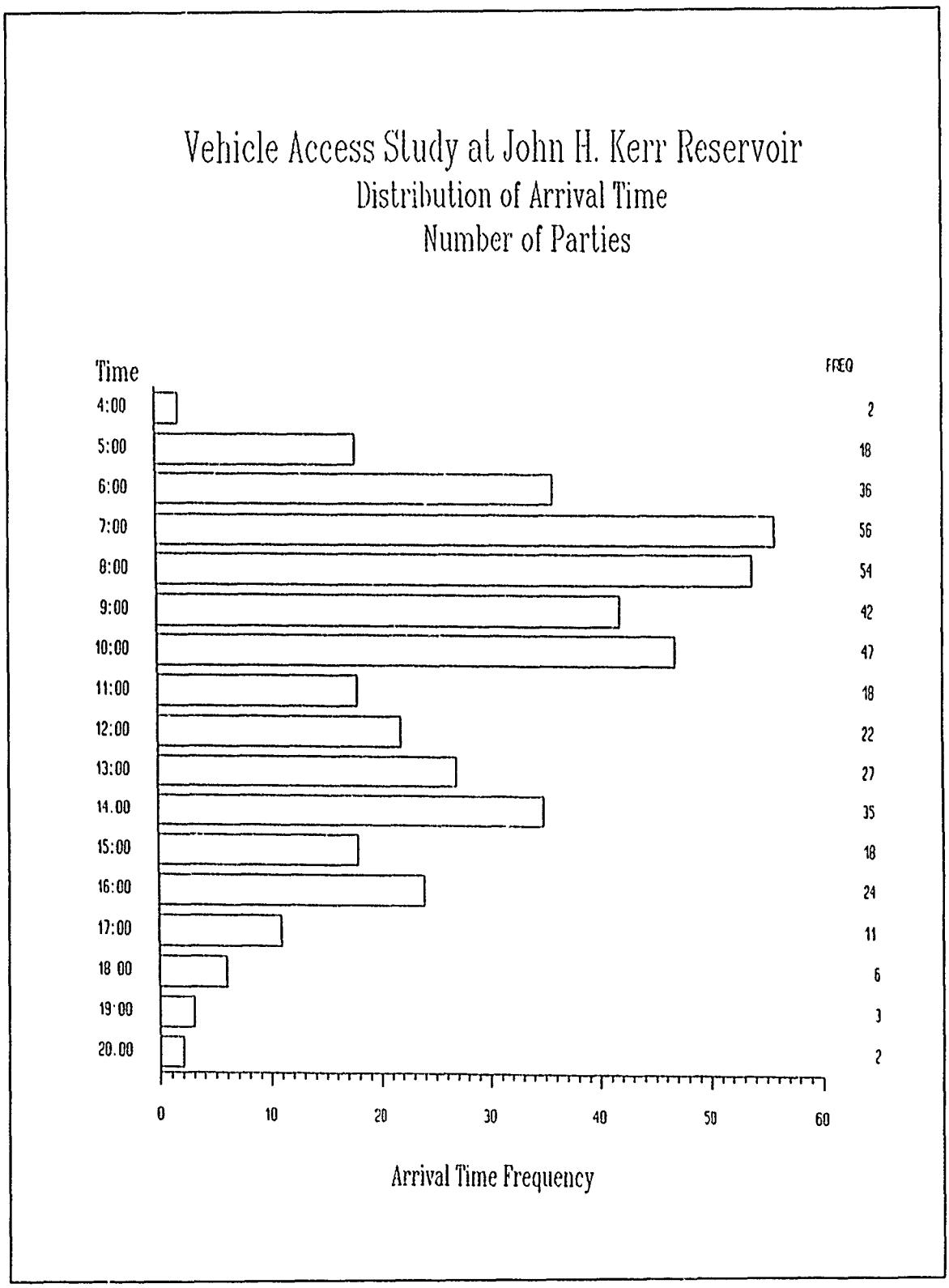

Figure 1. Distribution of arrival time

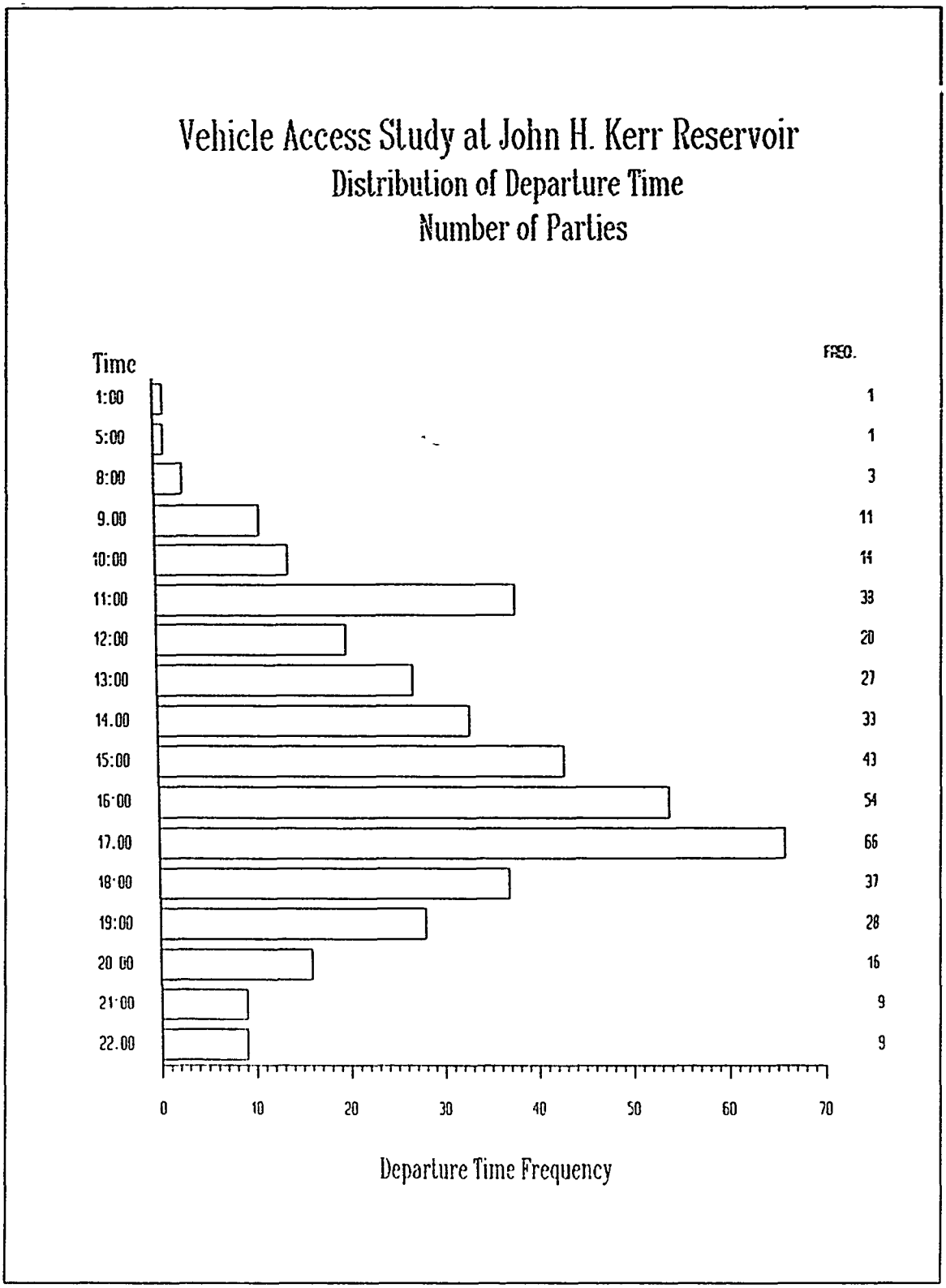

Figure 2. Distribution of departure time

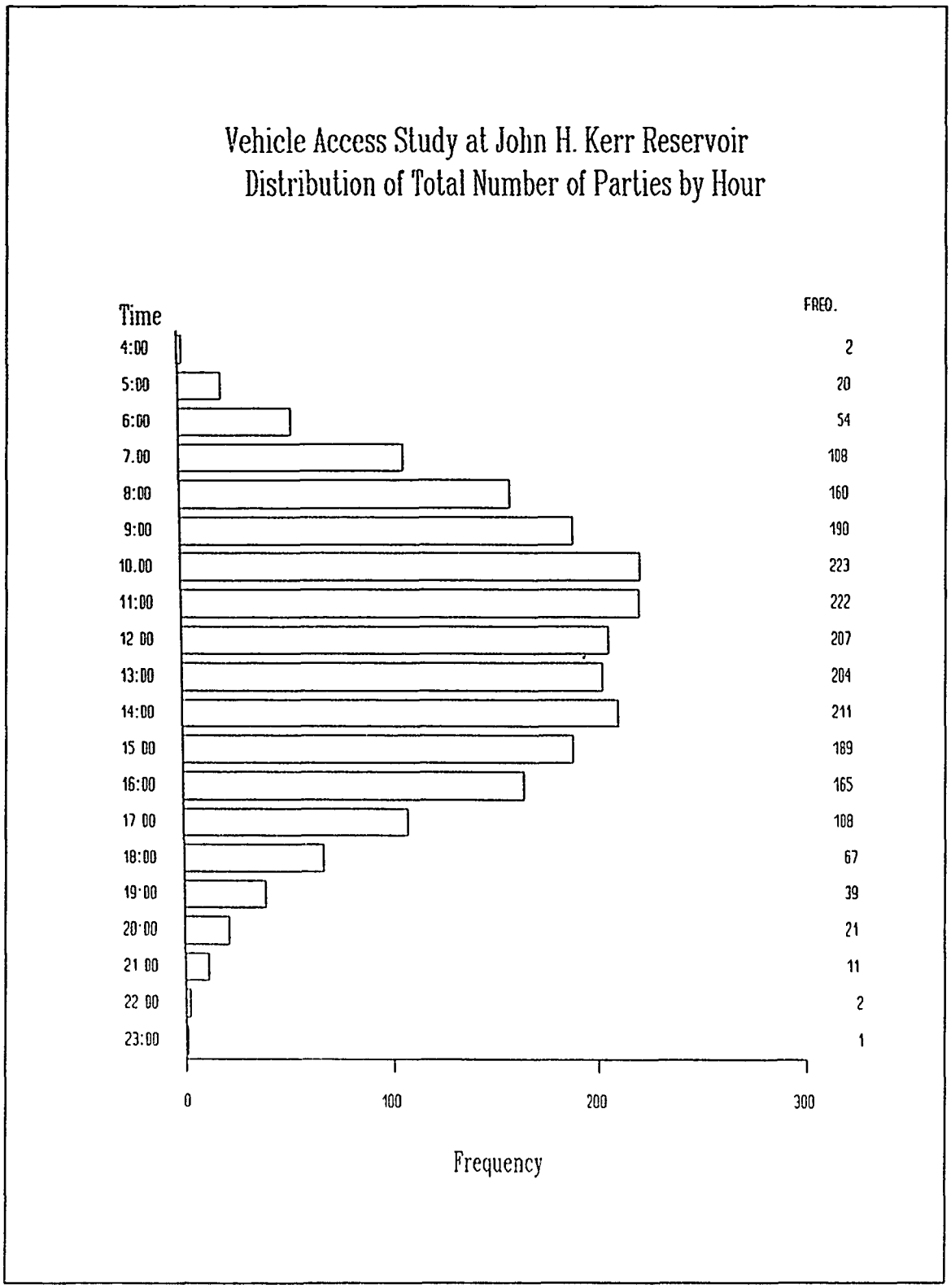

Figure 3. Distribution of total number of vehicles

using observational data obtained by surveyors to get such information as length of stay and number of people per vehicle. This may serve to reduce or eliminate in some cases the cost and time involved in surveying visitors. With additional refinement, this technique will hopefully be used for obtaining visitation estimates and use patterns in a variety of dispersed-use settings with multiple access points.

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Regional Recreation Demand Models

by
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Significant progress has been made since the last program review meeting on development of regional recreation demand models (RRDM) for the Corps of Engineers. Shortly after last year's review, a plan of study (POS) meeting provided input to a POS for the Work Unit (Henderson 1990). At this point, we are looking to going to Districts to acquire their visitation and Automated Use Permit System (AUPS) data as preparation for the development of the first model work.

Regional Models

Taken from the POS, a regional model "predicts recreation use and benefits for projects based on the variation of resource characteristics and the availability of substitutes," (Henderson 1990). Demand for recreation at a project varies with the quantity and quality of recreation resources at the project. Additionally, the recreation use is determined by user characteristics. Income, distance from a project, and costs associated with recreation travel are user characteristics that are utilized to predict recreation use.

The objective of this work unit is to develop models using data on project quantity and quality factors, along with user characteristics, to predict recreation use and benefits for Corps projects. The models are regional, rather than being models for a single project, in that recreation use is predicted, or allocated, to a project based on the characteristics of the project and availability and characteristics of competing substitute recreation resources. Regional models can be configured to incorporate hydrology, biotic production, and social components that could affect recreation demand for projects in a region (Cole et al 1990). The RRDM will be configured to predict recreation use, making connections to such things as fishery production as it can be reliably related to recreation use and reasonably be accommodated within the recreation use model.

Once developed, the Corps models can be used to evaluate changes in quality and quantity of recreation resources. The models will be used for determining changes in recreation use and benefits for:

a. New projects, to evaluate the recreation use and benefits at a proposed project.

b. Existing projects, showing how recreation is determined for a region, given the existing substitutes and resource conditions; and for modifications to operations, rehabilitation, or changes in natural resource conditions at existing projects.

Plan of Study

The POS meeting was held in May 1990 to obtain input from Planning and Operations personnel from project, District, Division, and Headquarters, US Army Corps of Engineers levels. Input was provided on needs and constraints for regional demand models for the Corps, as well as guidance on the process for model development and potential applications of the models.

Process for model development

A major recommendation of the POS meeting was to maximize use of existing data sets. Development of recreation models is dependent on the availability of data relating recreation use and benefits to management actions, changes in resources, or visitor use patterns (Henderson 1990). The most important piece of information

[1] US Army Engineer Waterways Experiment Station, Vicksburg, MS.

is the origin-destination (O-D) information. That is, predictive modelling of recreation use necessarily requires knowing where visitors to a project come from. In considering regional substitutes, the O-D data show, for recreators from a particular locale or origin, the demand for or participation rate for the different regional recreation alternatives. The ZIP CODES collected in the visitation surveys and the AUPS permits provide this important O-D data.

Use of the existing traffic stop visitation and AUPS data enables initiation of model development without having to wait for data collection. Work should focus on those regions where the Corps is a primary provider of recreation. That is, focus should be on the Districts where visitation surveys have been undertaken.

Considering applications to new projects, the planning load has shifted away from reservoir projects, and most of the planning effort is now on coastal projects, e.g., beach nourishment and small boat harbors. The Corps does not have recreation use data for these types of projects. Because of this, it was recommended that addressing the planning applications be delayed until after the reservoir models are in place.

Efforts should be made to identify whether other agencies have recreation use data, such as O-D data, that can be used. The National Marine Fisheries Service has collected marine fishing use data on national seashores, beaches, and other marine fishing sites (Leeworthy and Meade 1989). Other agencies, such as coastal zone management agencies and sea grant institutions, may have boating and other data that could be used for coastal applications. Planning personnel will have to further define the focus of these applications.

Applications

The potential application of regional demand models is broad, considering the ability to predict changes in recreation use caused by changes in natural resource characteristics and user characteristics. An increasingly important operations issue is the evaluation of user fees. Currently, fees are authorized for camping, but not for day use areas. Development of a regional model could evaluate the changes in use resulting from an increase in fees or institution of fees where none are currently charged.

Decisions about resource operations must often consider the impacts of closing recreation areas. With a regional model in place, the impact of area closings on total project visitation can be determined by evaluating the change in visitation, how visitation would be distributed to other projects, and the resulting change in benefits.

The fee structure and closing applications represent policy or management applications of a regional model to address operations decisions. A more resource-related application is the use of the models to predict changes in use and benefits associated with changing water levels (resulting from natural occurrences such as droughts or from reallocation of water to navigation or other project purposes). Changes in water levels affect the quality of the recreation experience, due to launch ramps and other facilities becoming unusable when pool levels drop, leaving the ramps out of water and revealing mud flats that interfere with access. The relationship of recreation use and different water levels could be quantitatively modelled, if records of visitation for the different water levels exist.

The planning applications identified were the coastal projects such as beach nourishment, jetties, harbor protection, and small boat harbor construction. No specific decision or resource-related applications were identified. It was recognized that the development of planning models would entail the acquisition of data from other agencies or the collection of data.

Model Development

During Fiscal Year 1991 (FY91), work has focused on evaluating the available data and acquiring capabilities to do the model development work. Using the FY90 Natural Resource Management System (NRMS) information, regions with current survey data were identified. Using the POS as a guide, a draft scope of work (SOW) was prepared for the model development and applications.

In February, a presentation was made to a meeting of research resource economists, known as the W133 Committee, and sponsored by the US Department of Agriculture. This presentation resulted in interest on the part of a group of research economists from the W133 Committee. Three members of the committee submitted a proposal to perform the work under an interagency agreement with the Agricultural Experiment Stations at their respective schools. It is anticipated that the interagency agreement will be in place by mid-summer. At that time, decisions will be made on what regions to use for model development. During the summer, meetings will be held at the Districts to initiate the modelling work.

The economists developing the models will have to acquire the necessary data for incorporation into the models. The types of data needed are listed in Table 1. It may be necessary to develop information on such things as recreation quality factors, e.g., fishing success rates. This will require coordination with State or local agencies that manage the fisheries or other resources at the projects. Facility information can be obtained from the NRMS for Corps projects and will have to be provided for State or local substitute sites. Demographic characteristics, not collected as part of the visitation surveys, can be determined from the census information for the counties of origin.

Table 1
Data for RRDM Models

Facilities at projects
Recreation quality
Income of visitors
Travel costs
Travel time
Substitute travel costs
Substitute recreation quality

It will be the job of the research economists to take the data and develop travel cost models that predict use, using the data in Table 1 as the predictors of recreation for projects and available substitutes in the region. The development of the Corps models will utilize data from three different regions, each representing different recreation conditions and types or levels of available data in regards to substitutes, recreation quality, and other information. Once developed, the models will be compared to identify consistencies and differences between the different region models.

Technology transfer

The POS meeting identified the need to document the decisions made in the model development process, identifying the resource, substitute, and other issues that affect the relationships of the model variables.

The economists are charged with documenting the modelling process in such a way that it can be repeated; the documentation can serve as guidance for model development in another region. With the regional models developed, to apply the model to another region, the District personnel will be able to take the process documented and either make adjustments based on the region's specific characteristics or build a new regional model, using the model documentation as a guide. Additionally, training materials for the regional models will be developed for incorporation into the Corps training course on recreation benefits.

Schedule

The research economists will begin work this summer to evaluate the visitation and AUPS data, and begin compiling the substitute and recreation quality data. Development of the regional models is scheduled to be completed during early FY93. As work progresses, there will periodic progress reports in *RECNOTES*.

Summary

The availability of RRDM will allow more informed evaluation of alternatives for such decisions as water reallocation, area closings, and changes in fees, as well as for evaluating new projects. Being able to predict how recreation use will change in response to these decisions will allow determination of associated change in recreation benefits. In making decisions about competing project purposes, it will then be possible to compare recreation benefits with the benefits of other project purposes.

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