US Army Corps of Engineers

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NATURAL RESOURCES
RESEARCH PROGRAM

PROCEEDINGS, 14TH ANNUAL MEETING, NATURAL RESOURCES RESEARCH PROGRAM

19-20 APRIL 1989
OMAHA, NEBRASKA

September 1989
Final Report

Prepared for DEPARTMENT OF THE ARMY
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Prepared by Environmental Laboratory
US Army Engineer Waterways Experiment Station
3909 Halls Ferry Road, Vicksburg, Mississippi 39180-6199

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The 14th Annual Meeting of the US Army Corps of Engineers Natural Resources Research Program was held in Omaha, NE, on 19-20 April 1989 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.

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PREFACE

The 14th Annual Meeting of the US Army Corps of Engineers Natural Resources Research Program was conducted in Omaha, NE, on 19-20 April 1989. The program review, required by the Directorate of Research and Development, was organized by personnel of the Natural Resources Research Program (NRRP), 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, NRRP. 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, NRRP, assisted by 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. Jessica S. Ruff 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.

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US Army Corps of Engineers
NATURAL RESOURCES RESEARCH PROGRAM

Omaha, Nebraska
19-20 April 1989

WEDNESDAY, 19 APRIL 1989
General Session, Regency Room

8:00 a.m.	Welcome - Commander, US Army Engineer Division, Missouri River
8:15 a.m.	Announcements and General Comments
8:30 a.m.	Darrell E. Lewis, Chief, Natural Resources Management Branch (NRMB), HQUSACE
9:00 a.m.	Judy Rice, NRRP Technical Monitor, NRMB
9:15 a.m.	Robert Daniel, NRRP Technical Monitor, Chief, Economics and Social Analysis Branch
9:30 a.m.	Break
9:50 a.m.	Don Dunwoody, Missouri River Division, Chief, Natural Resources Management Branch
10:10 a.m.	Theodore H. Schaefer, Omaha District, Chief, Natural Resources Management Branch
10:30 a.m.	Roy Proffitt, Park Manager, Salt Creek/Papio Field Office
10:50 a.m.	J. Lewis Decell, CEWES, Manager, NRRP, Plans for the Future
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6:00 p.m.
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THURSDAY, 20 APRIL 1989
Papio Natural Resources Building, Wehrspann Lake
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8:00 a.m. A. J. Anderson, NRRP

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9:15 a.m. Research and Demonstration System

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10:10 a.m. Wildlife and Habitat Management for Urban Water Resources Projects

10:20 a.m. Techniques for Restoring Sport and Commercial Fish Habitat in Aging Reservoirs

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-11:30 a.m. Lunch and Field Trip

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3:30 p.m. Adjourn

ATTENDEES

Hollis H. Allen
USAE Waterways Experiment Station
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

A. J. Anderson
USAE Waterways Experiment Station
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Cori Brown
USAE District, Baltimore
PO Box 1715
Baltimore, MD 21203-1715

Michael Carey
USAE District, Kansas City
700 Federal Bldg
Kansas City, MO 64106-2896

Debbie Chenoweth
USAE Division, Missouri River
PO Box 103 Downtown Station
Omaha, NE 68101-0103

Ellen Cummings
USAE Division, Missouri River
PO Box 103 Downtown Station
Omaha, NE 68101-0103

Robert Daniel
US Army Corps of Engineers
20 Massachusetts Ave. N.W.
Washington, DC 20314-1000

J. Lewis Decell
USAE Waterways Experiment Station
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Don Dunwoody
USAE Division, Missouri River
PO Box 103 Downtown Station
Omaha, NE 68101-0103

Gene Galloway
USAE Division, Missouri River
PO Box 103 Downtown Station
Omaha, NE 68101-0103

Sherman R. Gee
USAE Division, Ohio River
PO Box 1159
Cincinnati, OH 45201-1159

H. Roger Hamilton
USAE Waterways Experiment Station
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

William Hansen
Institute for Water Resources
Casey Bldg. #2594
Fort Belvoir, VA 22060-5586

Thomas L. Hart
USAE Waterways Experiment Station
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Dan Hayes
USAE District, Omaha
215 North 17th St.
Omaha, NE 68102-4978

Bob Heald
USAE Division, New England
424 Trapelo Road
Waltham, MA 02254-9149

R. Scott Jackson
USAE Waterways Experiment Station
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Mark R. King
USAE Division, Southwestern
1114 Commerce St.
Dallas, TX 75242-0216

Sandra Laney
USAE District, Omaha
215 North 17th St.
Omaha, NE 68102-4978

Darrell E. Lewis
US Army Corps of Engineers
20 Massachusetts Ave. N.W.
Washington, DC 20314-1000

Michael A. Loesch
USAE Division, North Central
536 S. Clark Street
Chicago, IL 60605-1592

Dick Makinen
US Army Corps of Engineers
20 Massachusetts Ave. N.W.
Washington, DC 20314-1000

Chester O. Martin
USAE Waterways Experiment Station
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Peg O'Bryan
USAE District, Omaha
215 North 17th St.
Omaha, NE 68102-4978

Mima Parra-Szijj
USAE District, Los Angeles
PO Box 2711
Los Angeles, CA 90053-2325

Betty Peake
USAE District, Omaha
215 North 17th St.
Omaha, NE 68102-4978

Paul Peloquin
USAE Division, North Pacific
PO Box 2870
Portland OR 97208-2870

M. Kathleen Perales
USAE Waterways Experiment Station
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Roy Proffitt
USAE District, Omaha
215 North 17th St.
Omaha, NE 68102-4978

Ron Rains
USAE Division, Ohio River
PO Box 1159
Cincinnati, OH 45201-1159

Judy Rice
US Army Corps of Engineers
20 Massachusetts Ave. N.W.
Washington, DC 20314-1000

William N. Rushing
US Army Corps of Engineers
20 Massachusetts Ave. N.W.
Washington, DC 20314-1000

Theodore H. Schaefer
USAE District, Omaha
215 North 17th St.
Omaha, NE 68102-4978

Billie H. Skinner
USAE Waterways Experiment Station
3909 Halls Ferry Rd.
Vicksburg, MS 39180-6199

Franklin Star
USAE District, St. Paul
1421 USPO & Custom House
180 East Kellogg Blvd.
St. Paul, MN 55101-1479

Joseph S. J. Tanner
USAE District, Wilmington
PO Box 1890
Wilmington, NC 28402-1890

Dick Taylor
USAE Division, Missouri River
PO Box 103 Downtown Station
Omaha, NE 68101-0103

Edwin A. Theriot
USAE Waterways Experiment Station
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Dan Troglin
USAE District, Portland
PO Box 2946
Portland, OR 97208-2946

Phil Turner
USAE Division, South Pacific
630 Sansome St., Rm 720
San Francisco, CA 94111-2206

John Tyger
USAE Division, North Pacific
PO Box 2870
Portland, OR 97208-2870

David Vader
USAE District, Omaha
215 North 17th St.
Omaha, NE 68102-4978

Michael R. Waring
USAE Waterways Experiment Station
3909 Halls Ferry Rd.
Vicksburg, MS 39180-6199

Susan Whittington
USAE Division, South Atlantic
77 Forsyth St., S.W.
Atlanta, GA 30335-6801

CONVERSION FACTORS, NON-SI TO SI (METRIC) UNITS OF MEASUREMENT

Non-SI units of measurement used in this report can be converted to SI (metric) units as follows:

Multiply	By	To Obtain
acres	4,046.873	square metres
feet	0.3048	metres
miles (US statute)	1.609347	kilometres
tons (2,000 pounds, mass)	907.1847	kilograms
tons (2,000 pounds, mass) per acre	0.224	kilograms per square metre

14th Annual Meeting
US Army Corps of Engineers

NATURAL RESOURCES RESEARCH PROGRAM

INTRODUCTION

The Corps of Engineers (CE) Natural Resources Research Program (NRRP) meets each year to provide for professional presentation of current research and to discuss related operations 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 and Research and Development Directorate of the Headquarters, US Army Corps of Engineers (HQUSACE); the Program Manager, NRRP; and representatives of the operations and planning elements of the CE Division and District offices, including those designated as Field Review Group (FRG) members for 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, each year in the form of quarterly progress reports and a final technical report. Each technical report is distributed widely in order to transfer technology to both the operating elements and the technical community.

Technology transfer to the field operations is accomplished through the Natural Resources Technical Support Program (NRTS), through the publication of REC-NOTES, technical reports and miscellaneous papers, and the conduct of workshops. Upon request, the 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 the 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 presentations and discussions of the 14th Annual Meeting held in Omaha, NE, on 19-20 April 1989.

Natural Resources Management Research Program Priorities

by

Darrell E. Lewis*

INTRODUCTION

It's a real pleasure to talk with you today about the Corps' Natural Resources Management research program. There are a few points that I would like to share with you regarding my thoughts on the program and the priorities that I see at work.

At the outset, I'd like to emphasize that, although my remarks reflect my views from the Operations side of the house, I continue to recognize the importance of this research program to our friends in Planning. This program has co-technical monitors--Judy Rice from the Natural Resources Management Branch in the Operations and Readiness Division and Bob Daniel from the Economic and Social Analysis Branch in the Planning Division. If you haven't, you should get acquainted with both of these folks while we are here in Omaha.

First, I'd like to mention a change we've made in the process for reviewing proposed programs for approval in HQUSACE. As most of you know, each year, after this program review group expresses its views on priorities of the various research projects, there are several other steps that follow. After this session the technical monitors will incorporate your views into the proposal for next year's research activity in this program. Last year, we initiated a new process as the next step. We briefed the Chiefs of Planning and Operations and Readiness Divisions on the proposed program. Waterways Experiment Station personnel conducted the briefing. Until last year these two key players were making the final decisions on funding priorities on research, with only sketchy information to work on in the Natural Resources Management research program. We were quite pleased with the interest and input we got at this briefing. I know all of us think that the program was strengthened by the input from this session. The two chiefs went into the Civil Works Research Committee Meeting (the last subject matter review process) with significantly higher knowledge of the content and importance of individual research projects. We think this has greatly enhanced the quality of the prioritization process.

RESEARCH PRIORITIES

Now, I'd like to talk about four priorities that I have for the Natural Resources Management Research Program. They are:

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* Chief, Natural Resources Management Branch, HQUSACE, Washington, DC.

- Integration into the mainstream of Corps Planning and Operations activities.
- Doing quality research.
- Involving research on a timely basis.
- Maintaining a pipeline for identifying research needs.

Integration

We can't afford to not have research as an integral part of our operations. Private industry uses research findings routinely as they carry out their profit-oriented objectives. It shouldn't be any different in the Corps. Whether it's planning or operations, research findings help keep us effective and efficient. Lewis Decell is making a sincere effort to involve everyone that uses the products of this program in the program. To make that happen, you need to meet him half way. When you have an opportunity to make input to the research program, take the time and effort to provide substantive ideas and suggestions. It will be time and effort well spent.

There are two excellent examples of research products moving right into the mainstream of Corps Natural Resources Management activities. First is the incorporation of economic impacts into the Operations performance indicator promise. That is taking research products as soon as they are available and incorporating them into the leading edge of our management activities. Second, the recreation use survey project is producing procedures that will become the Corps standard in the near future.

Quality research

The Corps has maintained a standard of excellence in everything we've done over the years. With scarce resources, it is essential that we ensure quality products in our research program.

Timeliness

It's too easy in these hectic times to deal only with today's problems. We all know that research takes time and, yet, a lot of our requests for research support are just not timely. We want answers to questions that will take years to research, and we want them now. It's amazing how some of the same urgent questions are still with us years after we decided we couldn't wait for research to answer them. For those of us who cannot wait, we have established the Natural Resources Technical Service to answer those immediate questions that can be handled with a minimum of effort. I think this has been a real success. We will try to continue to fund this program.

Identification of needs

As most of you know, we've tried several ways to involve project, District, and Division personnel in the process of identifying research needs. I'm convinced that we need something to accomplish this if we are to continue to have a viable natural

resources management research program. The folks at Waterways Experiment Station are there to help us, but they can't do that if we don't communicate our needs and priorities to them.

ONGOING PROJECTS

Before I finish, I want to comment on a couple of our research projects.

Economic impact

This project has come along slowly due to both the complexity of the task and the need to ensure credibility in all of the products. I'm convinced that this project is going to produce information that will provide the basis for many of the resource allocation decisions that need to be made in the future.

Visitation survey procedures

As decisions get tougher, the need for credible data increases. It is essential that we be able to accurately describe the levels of recreation use that Corps projects accommodate. You need to know that once WES completes the procedures for surveying recreation use, we will issue guidance that recreation use surveys be completed where not current, and that these procedures are the only acceptable means of collecting use data.

By the way, you'll be interested to know that we've "bitten the bullet" on Corps recreation visitation estimates. Approximately half of the Districts have now completed approved recreation use surveys. Our recreation visitation was reported to the Department of the Interior as 2.27 billion visitor hours. That's a healthy increase from previous years, but we're saying that our procedures are now sufficiently in place that this is a defendable number.

Regional demand model

As the Corps moves into a new era of dealing with cost-share partnerships, it is essential that we have credible models for predicting levels of recreation use. I'm pleased that we were able to manipulate our research budget so that we could initiate this project in 1989.

NATURAL RESOURCES MANAGEMENT SYSTEM

As the Corps' data base quality continues to improve, the Natural Resources Management System (NRMS) takes on more importance. The majority of the new Natural Resources Management performance indicators were derived from NRMS data. This allowed us to initiate a new program monitoring system with no new reporting requirements on the field! You should also know that the majority of our analyses for the various versions of the FY90 budget were based on the NRMS data base. We continue to stress the need for accurate data so we can respond accurately and quickly to the

seemingly endless string of questions. We were able to transfer large batches of data during this exercise, that we would never have been able to do manually in the time frames allowed.

In closing, I'd like to emphasize the need to make good decisions on what research we need to pursue, and then stay the course and finish what we start. The very nature of research demands rational decisions and a vision for the long term. That is what this group must provide as we undertake this program review.

Natural Resources Research Program

Judy Rice, Technical Monitor*

It feels a little odd to be standing in front of you as the tech monitor for the Natural Resources Research Program. Most of you have been directly involved with the program for some time, and I'm just the new kid on the block. When I arrived in OCE last October and my companion new kid, Steve Austin, joined me, our new supervisor, Jim Wolcott, took us aside and we talked about our assigned programs. "Judy, you get this and Steve, you get this, and Judy, the research program is yours." And I blithely and unwittingly said, "OK, sure." Little did I realize at that time just what that assignment entailed--how involved and how important the research program is. Since that time, I've had my eyes seriously opened.

I've talked some with Jess Pfeiffer and Bill Rushing in R&D, and some with Bob Daniel as co-tech monitor, and others in OCE. And I've talked some more with Lewis Decell and Andy Anderson and company. And I've come to realize the potential in the research program for helping the Corps manage its natural resources program better, for helping us understand the whys and from whences of our problems and the nature and process of their cures, and for providing an efficient vehicle for communication and information transfer both within the Corps and with other members of the natural resources community.

I had worked while at the Kansas City District with Scott Jackson, Kathy Perales, Janet Fritschen, and other staffers at WES. I knew I could go to them with some sticky problem or other, and they would handily provide just the help I needed. I was always impressed with their knowledge and competence and with their enthusiastic and cooperative response. As I've gotten to know these folks and the rest of the staff at WES better over the course of the last 7 months or so, I've become even more impressed with their capabilities and attitudes. I'm convinced that we have existing in this research and development program the tools we need to identify and address many of the kinds of problems we face as natural resource program managers.

As with all silver linings, however, there comes a cloud. The cloud I've found--or perhaps more correctly, that's found me--while I was discovering this abundance of ability and competence was a limit to funding. Although it's no surprise, it is disappointing that we can't fund everything everyone might have an interest in. So, as I understand it--as a novice preaching to the choir of experienced program reviewers gathered here--that's why we are here this week, to decide the direction of our research effort for FY90 given the limited funding we have available and the diversity of our interests and needs.

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* Natural Resources Management Branch, Operations and Readiness Division, HQUSACE, Washington, DC.

I am here to learn from all of you with your combined experience and knowledge more about this program, its history and current status--and from each of you with your own problems and needs, about your interests and priorities. I told you I had talked with R&D folks, Jess Pfeiffer and company, and with the WES folks, Lewis Decell and company. This is my time to talk with you and listen to you.

I am interested and enthusiastic about this program. I think we have marvelous potential here, and I'm excited about being involved as tech monitor. The best way you can help me catch up, understand the program, and make the best decisions is to talk to me. Tell me what you think this week, both in the working sessions scheduled and informally, one-on-one. Throughout the year, as something comes up, call me, educate me, holler at me if it's important and you think I'm not hearing you. Each of us in this room has a number of programs to manage. Sometimes the squeakiest wheel gets the attention. So squeak if need be, and I'll do the best I can for you.

I look forward to working with you in the times ahead. I will thank you now for the help and cooperation I know you will give me. Thank you.

Natural Resources Research Program

Robert Daniel, Technical Monitor*

In reference to earlier speakers,

- Darrell Lewis - I totally support the need to recognize that we are dealing with a market and not a free good when we provide recreational facilities or opportunities. Darrell is also correct in his assessment that any research we undertake must be credible, usable, operational, and current with the trends.

- COL Le Blonde [Deputy Commander, Missouri River Division] - I concur with the notion that there are competing water demands and the competition will increase in the future. We must be explicit about what product we are providing and why.

Briefly, I would like to mention these points with regard to the NRRP.

Structured process. Because of these competing demands and changing markets, we must be more structured in the way we determine what, when, and where to provide our products and how much they are worth. We need to be prepared to answer the increasing number of "what if" questions.

Cooperation. We need to continue to improve the relationship between Operations, Planning, and Engineering. There has been a great improvement at OCE in the past couple of years, largely due to the personalities of the Division Chiefs. However, it is incumbent upon each individual to do his/her part and not wait for some directive.

Budget. The Corps continues to face a declining budget in real dollars. The cuts for FY90 were most severe in the Operations and Maintenance area. Any cut in budget is most difficult to deal with in the O&M area because the projects are on the ground, demands on these projects are changing, and new projects that require additional dollars are being added each year.

Justification. Historically, the need to show economic justification for our proposals was largely confined to project formulation (feasibility and GDM) stages. The requirement continues to be expanded by OMB and the audit agencies. It is clear from the exercise we just went through on recreation areas and low-use harbors that we are not as well equipped to defend our positions or respond to "what if" questions as we should be.

Research. It is for the reasons discussed above that I have and will continue to push for incorporation of evaluation methods into the NRRP.

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* Economic and Social Analysis Branch, Planning Division, HQUSACE, Washington, DC.

US Army Engineer District, Omaha
Omaha, Nebraska

Theodore H. Schaefer

Stop for awhile with me and let us capture a moment in history, capture a day at a lake project, and capture a year in the Omaha District.

The story of the Corps of Engineers in the Omaha District is a parallel story of a great river--"the mighty Missouri."

In the beginning, the Missouri was a passageway in the exploration of western America. It became a determining factor. It nurtured settlements, towns, and eventually cities--Helena, Bismarck, Pierre, Omaha, Kansas City, St. Louis.

The Missouri River is a river unique and great in America. Its main stem and tributaries drain one sixth the land base of the United States. Its 2,315-mile* length crosses the heartland of the Nation, from the high peaks of the Rockies across the hign plains to the humid lowlands of the Mississippi Valley. The personality of the river has created a love/dependence/hate relationship with its users since they settled along its banks. Its shifting pattern of flow, volume, sediments, and obstructions creates its own floodplain and makes it almost seem as though it is living. It has been alternately blessed and cursed by those who have used it--explorers, traders, trappers, miners, steamboaters, and farmers. And today, while man has learned to control and live with the "Big Muddy," the marriage is still one of great caution and respect.

American author and humanist Mark Twain said, "This Missouri has more grief to the mile than any other waterway in America." Early American settlers' experiences, as Mark Twain wrote, were punctuated with calamity. FLOODS! The satisfactory solution of this problem was much debated and not resolved to any real degree until the Pick-Sloan program was adopted by Congress in 1944. Six main stem dams (Fort Peck, Garrison, Oahe, Big Bend, Fort Randall, and Gavin's Point) were built as part of the Pick-Sloan program and were designed to provide electric power, water for navigation, irrigation, flood control, recreation, and fish and wildlife benefits.

Hydropower

Hydropower is clean, nonconsumptive, and nonpolluting; provides cheap electricity; and produces 11 billion kilowatts, enough power to meet the needs of the states of Nebraska, South Dakota, North Dakota, and one half of Montana. The main stem system on power alone puts roughly $90 million a year back in the US Treasury.

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* A table of factors for converting non-SI units of measurement to SI (metric) units is presented on page viii.

Commerce

Seventy-three million tons of commercial traffic have been accounted for to date as barge traffic on the Missouri River from Sioux City to St. Louis. That amounts to $270 million in benefits derived. In addition, Missouri River accounts for 50 percent of flow in Mississippi River at St. Louis.

Irrigation

The reservoirs and river between projects provide irrigation water and stable flows for numerous private irrigators. This serves an estimated 300,000 acres.

Flood control

Since construction began, the Missouri River reservoirs have prevented $3 billion in damages. For the sake of comparison, the total cost of the system was about $1.2 billion.

Major floods. The magnitude of loss from major floods--such as those of 1943 and 1952--has been greatly diminished. Many cities and towns have had their flood threat virtually eliminated. Only 5 years ago, in 1984, above-normal amounts of precipitation and heavy Rocky Mountain runoff caused flooding throughout the region. But river cities were not affected. The six main stem dams prevented $97.1 in damages, precluding a replay of the horrendous flood of 1952.

1988 drought. The District manages 1.8 million acres in seven states. The drought of 1987 and 1988 is still fresh in our minds. Flood control was not a problem in these years. Neither was normal recreation. Inflows to the reservoirs were record lows. These years were the severest droughts of record.

As the recreation season progressed, so did the drought. Great anxieties were commonplace for the public, lake managers, and interested state agencies. Receding lake elevations also meant access to the lake for boaters and fishermen became extremely limited. This sobering situation became an all too familiar scene to ramp users at many ramps.

Corps employees extended existing ramps or built temporary ramps at the recreation areas. "Chasing the water" became the preoccupation of all the branches at the lake offices. This spring, the lake offices were able to expedite the awarding of construction contracts to build new low-water ramps and to extend ramps under emergency contracting authority.

Recreation and natural resources

Fort Peck Lake. Another benefit of the Pick-Sloan dams is recreation. There is a great divergence with respect to lake sizes, from very large to small. At the uppermost end of the main stem system on the Missouri River is Fort Peck. It is unique because the US Fish and Wildlife Service operates the Charles M. Russell Wildlife Refuge that surrounds Lake Peck. Fort Peck Lake has a hydraulically built dam and it is still one

of the largest dams built by that means in the world. Franklin Roosevelt authorized the construction in 1933 as a make work project. The original purposes were navigation, irrigation, and flood control, with hydropower being added in 1944. Recreation and fish and wildlife were not recognized as purposes of the dam, but were added later.

The Fort Peck Fisheries Habitat Evaluation and Improvement Study was begun in the spring of 1985 and completed in the winter of 1989. Previous efforts by the Montana Department of Fish, Wildlife, and Parks (MDFWP) to improve the fishery below the dam could not overcome the effects of fluctuating water levels. The District contracted with the MDFWP to investigate and alleviate many of the fisheries problems below Fort Peck Dam. A two-phased fisheries study was begun through the MDFWP in 1985 to identify and evaluate the impacts of the current operation of the Fort Peck project on the downstream fishery, and to test methods of reducing or eliminating these impacts through improved water management and habitat enhancement.

Lake Sakakawea. Lake Sakakawea held an Outdoor Safety Awareness Day and invited students from area schools to spend an entire day with rangers and volunteers to discuss how to enjoy a variety of recreational activities safely. Over 300 students participated. The students were divided into groups and rotated between stations. Boating safety, swimming safety, PFDs (personal flotation devices), first aid, poisonous plants, and off-road vehicles were just a few of the subjects. Each station provided the children "hands on" demonstrations or exercises. A PFD fashion show concluded the day's activities. McGruff the Crime Dog even stopped by for a visit to promote the lake's Park Watch program.

A lot of time last year was spent chasing the water, as mentioned earlier. This year, the use of indefinite quantities construction contracts at Lake Sakakawea allowed the project to get an early start on restoring/extending the boat ramps.

At the western end of Lake Sakakawea, several oil wells are on project lands. Historically, surface damage money for oil wells on project land has been processed with other real estate funds. In the fall of 1988, a new program was implemented. Oil companies perform wetland renovation projects. The oil company will perform work according to project specifications in lieu of paying the damage money. We feel this will have a positive impact for the area's waterfowl.

Pipestem Lake. In the spring of 1988, a 20-acre electric fence enclosure was built to protect upland nesting birds. The fence prevents predators such as fox and skunk from destroying nests and killing nesting birds within the enclosure. Studies have shown that in areas with predator control, nesting success is 90 percent. The entire enclosure was erected using volunteers, and money for all materials was donated.

Oahe Lake. The largest of the six main stem reservoirs of the Missouri River System is Lake Oahe. Lake Oahe is approximately 231 miles in length, or about the same distance between Washington, DC, and New York City. Oahe has approximately 2,240 miles of shoreline--about the same distance from Washington, DC, to Salt Lake City, Utah. In order to manage a project of this size, the natural resource staff developed an Operational Management Plan. This 5-year plan of Lake Oahe is a working document divided into three separate parts: Park Management, Natural Resources, and Mitigation. The data are stored on 41 diskettes to facilitate easy updating. They now

have the [illegible] review areas and analyze information about [illegible] ground truth. They also have the ability to make mini reports [illegible] work [illegible] with the public and other agencies.

The Omaha District is one of the few districts in the United States [illegible] cal Information System for natural resources work, although agencies [illegible] Service, BLM, and BIA have been using it for years. US Geological Survey [illegible] = 24,000') [illegible] our base map. These were 72 sheets digitized [illegible] overlays to [illegible] sheet. Data are stored on magnetic tape and can be [illegible] our Data [illegible] computer.

Oahe was [illegible] mitigating the state of South Dakota for flooded [illegible] of Lake Oahe. Mitigation is authorized under the authority of the Fish and Wildlife Coordination Act. Under a contract with the South Dakota Department of Game, Fish and Parks, [illegible] as this will be planted to various woody species [illegible] this. This new growth will provide more food and cover to a variety of species, increasing the carrying load of the project--mitigating for lost habitat. The difference between having and not having wildlife habitat. In other areas, trees will be planted and dense nesting cover will improve the area for upland wildlife.

Lake Sharpe and Papio/Salt Creek Lakes. Eroding banks are a consistent problem on the Missouri River lakes. In the past the solution has been a construction solution--riprap. At several of our projects, Big Bend and Papio/ Salt Creek Lakes, we have been experimenting with vegetative solutions. I'm sure Roy Proffitt will elaborate on this in his presentation and you may get a chance to witness some of the work tomorrow.

Lake Francis Case. The Fort Randall Project actually had a military post on it in the 1800s. The chapel is all that remains aboveground. For several years, summer volunteers have gathered to sift through the earth, layer by layer, to uncover artifacts. These are cataloged and stored. An interpretive trail is being developed by the District and project natural resources staff.

Lewis and Clark Lake. One of the two District regional visitor centers is located at Gavin's Point, a 3-hr drive northwest of Omaha. We are currently in the process of updating the exhibits in this facility using new audiovisual technology.

Not all of our projects are the size of Fort Peck, Sakakawea, or Oahe. There are a whole group of dams around Denver, Colorado, Omaha, and Lincoln, Nebraska, that are extremely important for flood control, but also provided recreation and open space in the midst of urban sprawl. The threat of flooding was of grave concern to the Denver community from the time of settlement until the Corps completed the Tri-Lakes Projects. Cherry Creek Dam was completed in 1950. Chatfield Dam was completed in 1977.

Cherry Creek, Chatfield, and Bear Creek Lakes. Denver's *line of defense* was fortified in 1979 with completion of the Bear Creek facility in Lakewood, Colorado. In addition to protection against flooding, the Tri-Lakes Projects provide the greater Denver metropolitan area recreation facilities at both Chatfield and Cherry Creek. They are leased to the state of Colorado and operated as state recreation areas. Together they

attract approximately 3 million visitors a year and account for a substantial percentage of visits to the entire state park system. Aside from the many traditional recreation facilities at these projects, you'll find such novelties as model airplane areas, shooting ranges, and even a hot air balloon launch site!

One of the District's regional visitor facilities was opened at Chatfield in 1983. The South Platte Visitor Center houses an impressive array of exhibits and is host to approximately 10,000 visitors a year.

The Omaha District, in cooperation with Missouri River Division, appreciates the opportunity to host the Waterways Experiment Station (WES) program. They, like WES, believe they are leaders in customer care.

Salt Creek-Papio Field Office

by

Roy Proffitt*

GEOGRAPHIC INFORMATION

The Salt Creek-Papio Field Office has responsibility for 14 reservoirs located in major metropolitan areas. The SMSA of Omaha is 600,000, and Lincoln is 250,000. Three reservoirs are within the City limits, and two others will soon be encompassed by the spreading City of Omaha. Our newest project, Dam Site 18, has yet to be impounded. The City of Omaha is rapidly surrounding the project. Last year, over 900 housing starts were begun on adjacent land. Many of the homes were in the $250,000 range. In the next year, two subdivisions are planned with development totaling $50 to $60 million.

We also have responsibilities along 200 miles of the Missouri River from Sioux City, Iowa, to Rulo, Nebraska. Located in this stretch is the Snyder-Winnebago complex, which encompasses two oxbow lakes along the river. This area is under the direction of the Iowa Department of Natural Resources to manage for wildlife purposes. Additionally, we have 10 access areas on the Missouri River with cost-shared facilities.

HISTORY

Our office was formed 3 years ago due to neglect--neglect by the Corps of Engineers and by our sponsoring agencies. During a 25-year period, the Corps had turned over 12 reservoirs to sponsoring agencies and left them to fend for themselves. When the Corps turned the reservoirs over to the sponsors, they did not have the expertise needed to operate and maintain them. Some sponsors had no signage programs, no pollution control, and no encroachment programs. There were numerous problems. The only time sponsors saw the Corps was during the annual management meeting or annual compliance inspection. The first meeting I attended with the City of Lincoln, they exclaimed how nice it was to see the Corps actually had faces. They had only heard voices on the phone. Previously the Corps had experienced problems with our sponsors when conducting meetings due to friction between agencies. Some meetings had degenerated to finger-pointing episodes. Correspondence and communication between agencies was practically nonexistent.

My first day on the job, I was given this guidance: (a) we do not want these projects back, (b) make the sponsors happy, and (c) cover your backside. We immediately set about to make changes with massive doses of communication. In 1987, we conducted

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* Park Manager, Salt Creek-Papio Field Office, Omaha, NE.

25 formal meetings and approximately 150 informal meetings. We discovered there is a time and place for each type of meeting. We also conducted 88 site inspections. We met and talked with everyone from the sponsoring agencies' Board of Directors to caretakers. We became masters of communication and coordination.

We implemented an internal policy to improve response time to our sponsors. We attempted to move all correspondence within 2 days of receipt. We channeled correspondence and inquiries to the proper District element. We soon discovered the District office had become constipated on paperwork. Therefore, we not only had to determine where the paperwork went but had to serve as a laxative to get it through the system. We began to track the status of important items through the bureaucracy. When the government's bowels moved, we discovered our sponsors became a lot happier and our headaches went away. Improving our response time and efficiency has benefited the Corps' credibility.

PROGRAMS

One of our main concerns in 1987 was the quality of the water. Impoundment of one project had been halted due to potential pollution problems. All of our reservoirs are located in a region with very pliable soil surfaces. Sediment inflows from adjacent lands were approaching 50 tons per acre annually. At Standing Bear Lake, sediment inflows had buried or knocked down hundreds of feet of fence. Erosion was also occurring on project lands. Shoreline erosion had already surpassed the "ultimate erosion line" in many areas. The bicycle path at Glen Cunningham was unusable due to numerous areas that had sloughed into the reservoir.

We began implementing corrective procedures using standard mechanical means. To save facilities and remove a safety hazard, we stabilized 1,320 ft of shoreline at a cost of $80,000. This was not a practical solution for the miles and miles of shoreline needing stabilization. To prevent sediment inflows resulting from urbanization, we began addressing construction activities adjacent to project lands. Through developers, we directed the installation of retaining structures and seeding operations. We implemented erosion control techniques on projects through contract and volunteer work. We are continuing this effort, using various types of matting and vegetation. We have also gone to our sponsors and various agencies for assistance in addressing erosion problems off project lands. The Soil Conservation Service and the Papio-Missouri River Natural Resources District have greatly aided us in this endeavor. Initiating good conservation practices is their agencies' mission. These agencies can meet with adjacent landowners onsite and cost share implementation of a conservation program on private lands.

At Standing Bear Lake, we treated sediment invasions as encroachments.

All adjacent landowners were addressed with requests to implement conservation programs. Working with the US Attorney, the Nebraska Department of Environmental Control, conservation agencies, and the landowners, we were able to achieve virtually 100 percent compliance. Adjacent lands have been terraced with grassed waterways, and tiled outlet structures or lands have been replanted into grassland.

To stabilize shorelines we began a cost-effective search for acceptable techniques. We went to WES with our problems. Aquatic plantings were deemed a good solution because they cost approximately one third to one half as much as conventional means. Aquatic vegetation additionally enhances water quality by reducing turbidity and removing nitrates. A bonus of the plants is the tremendous benefits to waterfowl and fish. In 1987, we received training at the shoreline revegetation workshop, and in 1988 we conducted our first planting at Wehrspann Lake. Using construction general funds, 1,200 ft of shoreline was planted with 12,000 plants. Much of this planting was conducted with the aid of volunteers.

The worst imaginable conditions ensued as the drought of '88 was under way. Plants were installed during a heat wave. The lowering water level resulted in placing the plants in a desert environment which then required irrigation. Foot traffic from park users also took its toll. The water level eventually dropped 7.5 ft, and weed invasion followed. All in all, we had a 30-percent survival rate. However, our nursery planting was a resounding success, as 300 plants multiplied to 15,000. Later in 1988, we conducted a second planting at Holmes Lake where geese devoured practically every plant a few hours after installation.

Although we have primarily cost-shared projects with sponsoring agencies providing routine O&M, we handle a number of small service and other contracts such as fencing, signing, mowing, refuse etc. This year we are trying to implement an IPA contract with the City of Omaha to formulate the operation and maintenance plan. Our forestry contract is somewhat unique. The contractor has not only installed over 100,000 trees, but also assists in interpretive and volunteer program. Our staff is intimately involved in the construction of all facilities at these 14 projects. From the time ideas are placed on the planning board until the projects are completed, we have our fingers in the pie. On construction projects, we work hand in hand with the Fort Crook Area Office. Our staff conducts weekly inspections focusing on progress and safety. During construction of handicapped facilities at Wehrspann Lake, we got the Paralyzed Veterans of America involved. To our amazement, we found some of the facilities were not functional for the handicapped. Designs were changed, modifications were initiated, and facilities were reworked. Now every facility at Wehrspann Lake is fully accessible to the handicapped.

Our claim to fame is through our volunteer program. It began in 1987 with [illegible] small projects. It began by working with the Audubon Society on wood duck box construction and Eagle Scout activities. Soon our program mushroomed to where we were doing lots of things occupying much of the staff's time. Realizing we had a gold mine of opportunity, the next year we were fortunate to enlist a University of Nebraska Omaha student to serve as a volunteer coordinator. She got university credit, and we got a lesson in enthusiasm and energy. During a 4-month period, she managed 44 activities in which 1,500 people participated. Activities included Federal Lands Cleanup Day, fish habitat construction, erosion control, aquatic revegetation, and many others. The value of the programs she coordinated was in excess of $40,000. Over the course of the year, we ended up with over $73,000 worth of volunteer work. Supplies and equipment were provided at a cost of approximately $3,000. Not only were we able to use volunteers, but our sponsors picked up on the idea. The Papio Missouri River

Natural Resources District now uses volunteers to run the Natural Resources Center on weekends.

We also gained recognition for the Recycle for Wildlife Drive last year. This 1-day activity was sponsored by the Omaha Area Board of Realtors and the Nebraska Game and Parks Commission. Several thousand people delivered tons of recyclable material to four pickup points. Proceeds from the refuse totaled just over $2,000. The money was then used on other volunteer projects such as the waterfowl observation blind at Wehrspann Lake. This structure is truly a community effort, as most of the lumber was provided by the Recycle Drive, the Millard Jaycees donated $200, and the Corps donated some material. The Audubon Society assisted in the selection of the construction site. The Papio-Missouri River Natural Resources District constructed an asphalt pathway for access. The Duck Callers Association designed and built the structure.

Volunteers have also constructed numerous fish habitat structures at Dam Site 18. Students, sportsmen's clubs, and the Nebraska Game and Parks Commission have built fish structures from tires, trees, and cinder block. In the past year, over 13,000 tires, 1,000 trees, and many tons of cement were assembled into structures. Additionally, developers and the Douglas County Highway Department have constructed trenches varying in width from 50 to 75 ft. The trenches will offer different zones of habitat for different species of fish.

Being so close to the District and Division Offices is both a blessing and a detriment. We are convenient for every activity, visiting official, and ceremony. We receive more than our share of attention and special activities. Being in a metropolitan area, our sponsors also receive excessive attention, especially for special events. When requested, we provide assistance in these endeavors. Otherwise, we monitor their programs. We estimate that between 900 to 1,000 special events occur over the course of a year. Our main function in this area is providing guidance and counseling to assist in better management of these activities.

Last, we are concerned with the safety of the recreational user and the elimination of safety concerns. We look at every aspect of project operations with safety in mind. From the planning of facilities to functional use, safety is stressed with staff, sponsoring agencies, contractors, and the public. We are active in our inspections and aggressive in corrections.

It should be emphasized that all 14 reservoirs are cost-shared projects. Each project is a gold mine of opportunity for the Corps and its sponsors.

Plans for the Future: Natural Resources Research Program

by

J. Lewis Decell*

Good morning! I want to take this opportunity to accomplish three things. First, I would like to inform you of the organizational changes at the Waterways Experiment Station (WES) that resulted in my involvement in the Natural Resources Research Program (NRRP). Second, I want to share some of my ideas and philosophies about what a research program should be and what I think needs to be achieved in the future. Third, I want to identify two long-range goals for the future of the Natural Resources Research Program.

ORGANIZATIONAL CHANGES

I will not dwell on all of the factors that led to the changes, but suffice it to say that it involved program needs, manpower considerations, and several other factors that converged to provide "a target of opportunity."

A new organizational element was formed in the Environmental Laboratory at WES, and I was assigned as Manager of this element. This office is the Environmental Resources Research and Assistance Programs (ERRAP), and my responsibilities include the management of three major Corps of Engineers research programs and two technical support programs. These are:

Aquatic Plant Control Research Program (APCRP)

Natural Resources Research Program (NRRP)

Water Quality Research Program (WQRP)

Natural Resources Technical Support (NRTS)

Water Operations Technical Support (WOTS)

I have two assistants, Dr. Andy Anderson, whom all of you know, and Mr. Bob Gunkel. Presently, Andy's responsibilities include the NRRP, NRTS, and WOTS. Bob Gunkel's include WQRP and certain major functions of the APCRP.

After the reorganization, my initial efforts were spent reading the history of the NRRP, starting with the Institute for Water Resources (IWR) report of May 1976, which contained recommendations for the Corps' Recreation Research Program (RRP). In 1986, a task force, chaired by Debbie Chenoweth, did an excellent job of compiling an extensive list of needs, based on input from over 200 people. Some of the needs were

* Manager, Natural Resources Research Program, US Army Engineer Waterways Experiment Station, Vicksburg, MS.

researchable; many were not. Interestingly, many were the same as those previously identified in the 1976 IWR report.

RESEARCH PROGRAMS

Before I talk about my views of what a research program should be, I want you to know that when I use the term "operations" I use it to represent the operating element, which includes both Planning and Operations.

My experience in managing research for the Corps has convinced me that the process of identifying problem-oriented research is not necessarily difficult, but it cannot be done alone by a research person nor can it be done alone by an operations person. Before the process can be efficiently completed, the researcher (the one who can define a potential solution) must sit down with the operations person (the one who can define the problem), and together, they must develop the final research work unit that reflects agreement that the subsequent effort will provide an applicable solution.

Research cannot directly solve the operations problem. Research can, however, with the proper understanding of the need, provide operations with the capability to solve their own problem! When the problem is identified, we in research must not focus so much on the problem itself, but on identifying this needed capability. Operations will then apply that capability and solve their own problem. Without the agreement between operations and research, and the focus on development of the capability, a work can be initiated and completed, and will be judged to have failed. Properly so.

In order for research to properly direct its efforts, there must be an understanding of the problems faced "in the trenches"--in this case, I believe that is usually at the project level. When you can identify the problems at the firing line level, you find out just how wide and long and muddy the trenches really are!

I believe that in the hierarchy of our organization, the majority of problems most amenable to research are identified at the project level. The fewest are identified at Division level. This is not to say that the problems at the Divisions and Districts aren't real; they are. Properly identified research work units must not only reflect a knowledge of the project-level problem, but must also be compatible with the District and Division's perception of the project's needs. The more general objectives of a well-structured overall program are the results that satisfy the needs of the higher levels. Research work units designed to first meet the project-level need can satisfy the higher level needs. The converse is not true, except by serendipity.

GOALS

Research programs in the Corps of Engineers must serve the operational needs and, to effectively do this, must by nature of these needs be more applied than basic. The test that confirms that a program is properly serving these needs is when operations personnel recognize the research as theirs. Without this recognition by the people who need the results, any research program runs the risk of conducting research for the sake of research. My first goal is to have you, as the judges, clearly recognize the NRRP as

yours. To achieve this, each work unit must clearly reflect both a knowledge of the problem and your agreement as to the product to be obtained.

My second and longer range goal is to have the Corps NRRP recognized as a technology leader on a national level. It is my opinion that, at present, we are not considered by other Federal agencies or universities engaged in similar or related research as technical peers, on a level commensurate with our abilities.

PLANS FOR THE FUTURE

Several related things will need to be accomplished if progress toward these goals is to be realized. I would like to identify these and comment on my perspective of their value.

We must develop a structure for the future research that relates the individual work units together as technology development thrusts, which are in turn related to each other to form the Corp's overall program objectives. When organized in this manner, all research work units within a given area will be related, and will contribute to the overall technology development of that area. When the future program is reviewed, it will allow you to discuss and answer the basic question of whether or not we need to be in the business of developing a particular technology. The answer will usually be yes. The value of this structure is in maintaining continuity to the overall research program, as the research units can be first prioritized within their respective technology areas. This minimizes the effect of a work unit in one technology area being placed in direct competition with work units in another technology area. The continual input provided by the review process will eventually define the overall scope and rank of the technology areas.

Each year, we will provide you with an advance package of work units, so that you will have the opportunity to come to the review prepared. This package will include research to be considered in the future for program development.

We plan to have each year's program review in a different Division. The first 1 or 2 days will consist of presentations providing details on NRRP research as well as research from other agencies and universities. Equally important, you will be invited to present operational problems and situations that are of interest to the Corps. The last day of the meeting will be devoted to the official Civil Works R&D Program Review, conducted by CERD-C, where your input is solicited. Something we would ask you to consider, when reviewing the research and providing your input, is that there are no annual on-off switches on research program elements, without paying a penalty. This penalty is usually forfeiture of continuity, resulting in a loss of results. If you have initiated a 2- or 3-year work unit, you should demand a periodic status report. But you should be prepared to provide continued support and guidance until it is completed. I will be the first to recommend to you that a research unit be terminated for nonproductive performance. If I am doing my job, however, we will be managing in such a manner as to prevent that occurrence. Obviously, each year there will be tight budgets, changing priorities, and additional needs that seem more urgent than the last year's. That's the environment management operates in continually. Our job is to maintain our program

with the continuity of focused objectives that assures success, in spite of that environment.

Each year we will publish a proceedings of this annual meeting and program review. This should include presentations and text provided by field office representatives. It is most important that what is discussed at this forum is set in print--as our annual record. It will serve to provide us with a reference of how we got to the present, and to remind us to focus on the future.

We would like an invitation to attend the annual Natural Resource Managers' meeting held in the various Divisions and Districts each year. Andy or I would like to give a presentation at each meeting to provide you with a status report on what we are doing, and where we think we are going in the NRRP. Moreover, it would provide us an opportunity to discuss, in detail, your problems and how the NRRP can better serve your needs. We would also give you an overview of the NRTS activities, and the procedures for using NRTS. Obviously we will not be able to attend all of these meetings. However, over a period of 2 to 3 years, we can interact with a great number of you and gain a much better appreciation for your needs.

We also solicit your invitation to visit two or three projects each year to "see the real world" in action. During these visits I want to schedule time to sit down with the Resource Manager and his staff to discuss problems, and the NRRP and NRTS as one method of obtaining their input.

I will recommend to the technical monitors that we reconvene the fall meeting of the Field Review Group (FRG). I think this would be very valuable to Judy and Bob as well as WES and the FRG to have these detailed discussions prior to the spring program reviews.

We must increase the general knowledge of the NRRP's existence, both in and out of the Corps. We must achieve greater visibility in the national technical arena and peer groups, and we must increase our scientists' contributions to professional journals and societies.

The past 2 years has been very busy and eventful. I want to thank Andy Anderson and Roger Hamilton at WES for their support, during a very volatile time of transition. I want to also thank Darrell Lewis for his support and patience in granting me the time to redirect the research program. Especially, I want to thank Judy Rice and Bob Daniel, the Technical Monitors. They have not only been supportive and understanding, but have arranged for some very important briefings that will pay dividends in the future. I am looking forward to a very productive future, and to working with each of you.

Falls Lake, North Carolina--Boating Saturation Study

by

Joseph S. J. Tanner*

Boating saturation???

What does it really mean?

When does it occur?

When are there too many boats on a body of water?

When do unsafe conditions exist, or at what point is user satisfaction affected?

What steps are necessary to reduce or eliminate the problem if we find one exists?

Or to be better, more innovative managers, what should we do to prevent the problem before it occurs? That's really the best scenario.

These are the same questions we have about Falls Lake, which is located near one of the most populated areas of North Carolina. We lie in the center of the state only about a half mile from the cities of Raleigh and Durham.

The Project is a relatively new "89-72" cost-shared project that was impounded in 1983. Of the 11,600 surface acres of water on the lake, only about 7,000 acres have water depths conducive to pleasure boating and skiing. The average depth at normal pool of the other 4,600 acres is only about 2 ft.

We recognized early in the planning stages of the Project that crowded conditions on the lake would eventually become a problem. But, we felt we could develop some of the facilities and wait for warning signs to appear before those questions on boating saturation had to be answered. To our surprise, the flags began flying early in the life of the Project, soon after the lake and boat ramps were opened in 1983. And they are still flying. For example:

- The number of boating and skiing accidents has increased.
- Visitation figures have soared from 800,000 in 1983 to 2.2 million visitors in 1988. That doesn't seem like a very high figure compared with some other Corps lakes across the country, but it is when you consider that no campground facilities have been completed, that there is only one swim beach open with some incidental picnic sites available, and there is only one small marina. And, oh yes, there are six boat ramp access areas with a total of 24 launch lanes located throughout the Project.

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* Resource Manager, Falls Lake Project, North Carolina.

It's not so surprising that most of the users at Falls Lake are day-use boaters. And believe me, these boaters almost fight to launch their boats on Saturdays and Sundays from April to July. In fact, I suppose the crowded conditions at the ramps was the first sign that indicated the problem already existed. At some ramps late in the afternoon on weekends, it was common for a boater to spend as long as 45 minutes to an hour to either launch or retrieve a boat. Tempers flared, especially among those that had been partaking in alcohol; name calling and fist fights became common, and complaints from the using public of overcrowded conditions at the ramps were all too common on almost every Monday morning.

We knew that we had a problem, and it wasn't going to get better on its own. Also, we have only begun developing the recreation facilities on the project, and most of the remaining development is going to only increase the number of boats on the water. For instance, plans are to develop about 500 campsites at which campers will be allowed to beach their boats overnight near the campsite; the marina operator has plans to increase the number of wet storage slips from 100 to about 400; and in the next 3 years, we have plans to provide access to three additional ramps that are already constructed.

This development, coupled with the increase in boat sales across the country and the problems with the rapidly growing popularity of the nontraditional water crafts such as jet skis and sailboards that can be launched at almost any shoreline location, is evidence to me that we must know the carrying capacities of our lake so that we can make some wise and sound decisions about what and how many facilities should be developed and what types of restrictions are needed.

I guess that we can say that we have arrived. We are faced not only with problems that are future, but also with problems that are present. But we have started. And that is a GIANT STEP in the right direction. Sometimes "starting" is the most difficult part of accomplishing a task.

Let me stress the word "WE," because the Corps has not shouldered this problem without help! Remember, this is not a traditional Corps project. This is an "89-72" project, and at "89-72" projects we have more than just customers; we have partners. Thank goodness, our partner, the state of North Carolina, is equally concerned about this problem.

After some discussion in a "high-level" State-Corps coordination meeting in September 1987, a decision was made to establish a Boating Saturation Task Force to address the problem and develop plans to prevent or control this ever-growing management and safety concern.

The good news for us was that this problem was not new or unique to Falls Lake. Other lakes throughout the country, both Corps and non-Corps, had had similar concerns and had already undertaken boating use studies. It was the hope of the Task Force to simply adopt the methodology of an existing study; make some minor adjustments to fit our particular needs; gather the necessary data; and develop a plan to remedy the problem.

Not such a "big deal." With all the expertise from the State and the Corps, there was no question that we could handle this. Furthermore, we even had a University close by that offered us assistance in performing the survey, in analyzing the data, and making

recommendations to control the situation. And to put the "topping on the cake," this assistance would not cost the Corps or the State a penny. This was everything the Task Force needed--for someone to perform the mission, free of charge. We surely didn't have the funds for a study like this. We only had some manpower to support someone else in gathering the data.

Everything was working great. It was almost too good to be true. What an understatement. Let me say that another way. It was too good to be true.

The University was given the lead and was to contact us after some preliminary plans had been formalized. Well, we waited and waited and still heard nothing from the University. That's when we realized that maybe we had a problem. When we finally met with them, we discovered that the University didn't want or need our help. They were so eager to complete the mission that they began designing a research program for us without the "us" being involved. Our goals and objectives had been changed. Even the original problem itself had been changed so drastically that we didn't even recognize it as the same one.

We realized quickly that we were NOT experts in research methods. And as badly as I hate to admit it, we realized that help was needed.

From the beginning, the Wilmington District had been very supportive in our endeavors and had given us more than enough rope. But we knew that the District didn't have the answers and that we were going to have to go elsewhere for help. So, the Task Force members met without anyone from the University present and decided to order another 500 ft of rope so that, like the District, we could issue it to someone else.

That's when we learned a little bit about the folks at the Waterways Experiment Station. You all know the place--where those "researchers" are always pleading and begging for more and more "rope."

Let me tell you, I was very apprehensive about becoming involved with WES. I didn't know anyone there, and I didn't know their language. Yes, I had spoken to Dr. Andy Anderson and Scott Jackson at several meetings across the country. And I even felt a little bit comfortable in calling them by their first names in some of those brief conversations. But our conversations had been mostly about the weather, surely not about anything substantial. These people were researchers and they were not interested in small problems like the one we had at "small-town" Falls Lake in "little ole" North Carolina. And if they were interested in helping, we could be assured of a big price tag being attached. Again, we didn't have any money.

Fortunately, about the same time we were organizing the Task Force in Raleigh, Gerald Purvis in Atlanta was busy writing a "memo" to all the projects in the South Atlantic Division (SAD) explaining, in Resource Managers' language, the Natural Resources Technical Support Program. Yes, I had heard of this, but felt it was for someone else! But apparently Gerald realized our apprehensions. He realized that the Managers didn't understand that "WES will provide technical assistance on any problem free of charge when it requires less than 1 week." He really got my attention when he said "any problem" and "free of charge."

Let me tell you what else he said. He said that he believed the program can help us (the Projects), but we (meaning SAD and WES) must find a better way to apply it and "WIN the trust and respect of the Projects." He was so right.

Gerald was convincing this time. So we picked up the phone, called those people that beg for rope, and began our "relationship" with WES and Scott Jackson.

In addition to our telephone conversations, Scott and I also had an opportunity to discuss these problems at the Natural Resources Managers Conference last January in Las Vegas. I was shocked! He listened; he was interested; and I thought he even understood the problem, for he was at that time "wrapping up" a similar study at the Raystown Lake in Baltimore District.

All we had to do was request assistance through the District. And the next thing I know, in the early part of March, Scott arrived in Raleigh to meet with the Task Force and the University where he helped us out of a really awkward situation. I don't know how, but it worked well and without any hard feelings.

And even when Scott returned to WES, the ball kept rolling. In the summary of his trip report, he recommended that a public interview used in the Raystown Lake study be abbreviated and used at Falls and Jordan Lakes during the 1988 Recreation Season. This limited information would provide an indication of the presence or absence of a problem.

He further indicated that WES could provide support in preparing the questionnaire and the technical assistance in administering the survey, again under the Natural Resources Technical Support Program. This sounded pretty good to me, but I was still somewhat apprehensive.

Again, to my surprise, things moved right along, and on June 22, another researcher from WES by the name of John Titre arrived at the Project with a stack of about 200 blue questionnaires. He was very eager and ready to complete the mission. But he wasn't so ready that he wanted to fire the rifle before he aimed. He was there to do it by the numbers: 1, 2, 3, Ready, Aim, Fire.

This was the second "researcher" from WES that I had met that was more interested in listening to what I thought about the problem rather than trying to impress me by telling me what he knew about the other world situations. His message was that he was there to help me, and even though I had heard that many, many times before, I think that I was beginning to believe him.

We accomplished a great deal in the 7 days that John was there:

- We discussed the questionnaire and changed it to include other questions that were important to the Project.
- John toured the Project so that he could better analyze the situation.
- Interviewers were trained.
- The data were gathered and put into the computer.

- John presented the computer results.
- We discussed specific observations.

This wasn't just a John Titre or WES effort. It was a team effort from the beginning to the end. And it was a revelation for me.

And yes, the results did indicate that crowded conditions existed and a more in-depth study was necessary. That was the mission. To find out if a problem existed or not.

The abbreviated study had two other spinoff benefits that really excite me.

First, it introduced us to a way to get the public or the customer involved, and at the same time make them feel a part the Project. We all realize the importance of public involvement, but we don't always know how to accomplish it. Furthermore, believe it or not, the public really isn't as stupid as we sometimes think. Some of their recommendations had lots of merit and, if implemented, could help ease the problem somewhat.

The second spinoff benefit of establishing a relationship with WES and the research world is really the most exciting to me. And my one message for all projects throughout the Corps world, no matter what type they are, is that WES and "small town" Falls Lake in "little ole" North Carolina have a success story to tell.

And Gerald, your mission has also been accomplished. WES has won that trust and respect it so desperately needed and wanted, especially at one project. But the only way they gained that trust was for us, the Project, to take that "giant step," to "get started," and realize that we can't do everything alone.

NATURAL RESOURCE MANAGERS FORUM

BRAINSTORMING SESSION

As part of the 1989 meeting, a session was held the first day that brought together everyone for a "brainstorming session." This session was intended to allow for discussion, questions, and answers and was not restricted to any items of a particular interest. Mr. Darrell E. Lewis, Chief, Natural Resources Management Branch (NRMB), HQUSACE, moderated the session, assisted by Ms. Judy Rice, NRMB.

The session was initiated by identifying topics of interest to the participants, and then discussing each one individually. A list of these topics follows.

An attempt was made to record the discussions on video tape, for subsequent transcription, editing, and publishing. However, transcription of the information from the tape to paper proved to be too arduous to allow timely publication and distribution of the proceedings. The list of topics has been included, and the video tape has been provided to CECW-ON for safe keeping.

For subsequent meetings, plans to record the discussions will be initiated in time to ensure that the method used will allow for more efficient transcription to ensure timely publication.

- OPEN SPACE VALUES - VALUE OF INTANGIBLES
- VALUE OF DISPERSED RECREATION
- EVALUATION OF MANAGEMENT DECISIONS
- MINIMUM TIMBER HARVEST SIZE
- ECONOMIC BENEFITS OF PROJECT PURPOSES
- DETERMINING DOLLAR VALUE OF PUBLIC LANDS FOR FUTURE-FINITE RESOURCES
- WATER SAFETY - EFFECTIVENESS OF EFFORTS
- VISITATION - NATURAL RESOURCE MANAGEMENT SYSTEM - ACCURACY - SIMPLIFY PROCEDURE
- IMPACTS OF SURROUNDING DEVELOPMENT ON CORPS LAND
- CULTURAL RESOURCES
    * Signing
    * Curation of artifacts
    * Site protection
    * How to: Enforcement options
- EIS-PREDICTED IMPACTS ACCURACY - EIS FOLLOW-UP

- ECONOMIC VALUE OF WATER QUALITY
- GEOGRAPHIC INFORMATION SYSTEM IMPLEMENTATION
- MANAGEMENT OF AGING LAKES
- WETLAND DEVELOPMENT
- TECHNOLOGY TRANSFER - INFORMATION EXCHANGE
- RESEARCH CLEARINGHOUSE - INTERAGENCY
- CORPSWIDE RESOURCE INVENTORY
- TAILWATERS - WHAT'S DANGEROUS
- DAY-USE FACILITIES - WHAT SHOULD WE PROVIDE?
- FEE COLLECTION - IMPLEMENTATION STRATEGY
- DEMOGRAPHIC TRENDS - AGING USERS
- SAILBOARD MANAGEMENT
- WHO WILL BE IMPACTED BY NEW FEES? USE FEES AS MANAGEMENT TOOL
- HOW DO WE USE THE INFORMATION WE COLLECT? ORIGIN OF INFORMATION REQUESTS?
- REGIONAL FACTORS FOR VISITATION COMPUTATION
- BOATING SATURATION - WHAT TO DO WHEN YOU GET THERE
- CORPS OF ENGINEERS WILDLIFE RESOURCES MANUAL AS TECHNOLOGY TRANSFER VEHICLE
- INADEQUATE ACCESS TO PROJECT LANDS OR TOO MUCH ACCESS
- STANDARDIZED SOFTWARE
- RESEARCH LIBRARY
- SHORELINE EROSION - WATERSHED MANAGEMENT - SILTATION FROM ADJACENT AREAS
- EDUCATE CORPS CONCERNING THE RESEARCH PROGRAM - RESULTS - REPORTS - WHAT'S AVAILABLE
- WHITE-WATER RELEASES - USE CONFLICTS
- CHARGES TO RECOUP COST OF RELEASES FOR OUTSIDE INTERESTS
- GUIDANCE FOR DEALING WITH DIFFERENT INTEREST GROUPS

- GROSS AGENCY/REGIONAL MARKETING
- WATERFOWL MANAGEMENT - ONE MORE TASK?
- REGIONAL ASPECTS OF WILDLIFE MANAGEMENT
- INCORPORATING DEMOGRAPHIC TRENDS IN MANAGEMENT PRACTICES
- CLOSURE CRITERIA - CRITERIA TO EVALUATE AREAS

FY90 CIVIL WORKS RESEARCH AND DEVELOPMENT PROGRAM REVIEW

NATURAL RESOURCES RESEARCH PROGRAM

NATURAL RESOURCES RESEARCH PROGRAM

Civil Works R&D Program Review

ATTENDEE LIST

Name	Office Symbol	Telephone
A. J. Anderson	CEWES-EP-L	601-634-3657
Cori Brown	CENAB-OP-PN	301-962-3693
Michael Carey	CEMRK-OD-R	816-426-3252
Ellen Cummings	CEMRD-PD-R	402-221-7281
Bob Daniel	CECW-PD	202-272-8568
J. Lewis Decell	CEWES-EP-L	601-634-3494
Don Dunwoody	CEMRD-CO-R	402-221-7284
Gene Galloway	CEMRD-PD-R	402-221-7280
S. R. Gee	CEORD-CO	513-684-3192
H. Roger Hamilton	CEWES-ER-A	601-634-3724
William Hansen	CEWRC-IWR-R	202-355-3089
Mark C. Harberg	CEMRO-PD-M	402-221-4885
Thomas L. Hart	CEWES-ES-A	601-634-3449
Dan Hayes	CEMRO-OP-NP	402-896-0723
Bob Heald	CENED-OD-P	617-647-8305
R. Scott Jackson	CEWES-ER-R	601-634-2105
Mark R. King	CESWD-CO-R	214-767-2435
Darrell E. Lewis	CECW-ON	202-272-0247
Michael A. Loesch	CENCD-CO-MO	312-353-7762
Dick Makinen	CECW-RE	202-272-0166
Chester O. Martin	CEWES-ER-R	601-634-3958
Peg O'Bryan	CEMRO-OP-N	402-221-4175
Betty Peake	CEMRO-PD-A	402-221-4474
Paul Peloquin	CENPD-CO-R	503-326-6857
M. Kathleen Perales	CEWES-ER-R	601-634-3779

Name	Office Symbol	Telephone
Roy Proffitt	CEMRO-OP-NP	402-896-0723
Ron Rains	CEORN-OR-R	615-736-5115
Judy Rice	CECW-ON	202-272-1796
William N. Rushing	CERD-C	202-272-1841
Billie H. Skinner	CEWES-EP-L	601-634-3701
Franklin Star	CENCS-CO-PO	612-220-0327
Joseph S. J. Tanner	CESAW-CO-RF	919-846-9337
Edwin A. Theriot	CEWES-ER-A	601-634-2678
Marty Timmerwilke	CEMRO-OP-N	402-221-4137
Dan Troglin	CENPP-OP-PN	503-326-6868
Phil Turner	CESPD-CO-O	415-556-2648
John Tyger	CENPD-PL-ER	503-326-3829
Michael R. Waring	CEWES-ER-R	601-634-2290
Susan Whittington	CESAD-CO-R	404-331-6807

Measurement of Economic Impacts Associated with Recreational Use of Corps Projects

by

R. Scott Jackson*

PROBLEM

The Corps of Engineers has traditionally measured the benefits of recreation programs and development in terms of direct benefit to the visitor. Benefit in this instance is defined as the total willingness to pay for a particular recreational opportunity minus the cost incurred to participate in the activity. Valuation techniques (such as travel cost, unit day, and contingent valuation) are employed to compute benefit-cost ratios for decision-making purposes. These procedures, however, ignore the benefits to local and regional economies derived from the expenditures that visitors make in association with the recreational use of Corps projects.

TYPES OF ECONOMIC IMPACTS

Economic impact can be viewed as the income local or regional businesses derive as a direct or indirect result of expenditures made by visitors to Corps of Engineers projects. Direct impact is the income derived directly from visitor expenditures such as the retail sale of a boat. Indirect impacts include the income the boat dealer provides to others in conjunction with the sale of the boat, including salaries for sales staff, utilities, and the wholesale purchase of the boat. Indirect impacts are in part defined in terms of multipliers.

Two types of economic analysis have gained popularity in valuing recreation resources and programs. The type of analysis selected depends on the specific questions posed. The first is a measure of economic significance, which can be defined as the total direct and indirect impacts from expenditures by all visitors to the recreation site. The second is economic impact, which includes the total direct and indirect impacts from expenditures by visitors from outside a specified region. Economic impact analysis therefore measures the full effect of new dollars into a regional economy. The definition of a region is a crucial step in economic impact analysis. A region may be defined as a single county or an entire state. As a rule, the larger the region is, the smaller the direct impacts are but the larger the multipliers applied to direct impacts.

* US Army Engineer Waterways Experiment Station, Vicksburg, MS.

PROCEDURES

Direct expenditures are measured with a variety of methods, including the monitoring of tax receipts, surveys of local businesses, and the use of other secondary sources of sales data. A visitor survey is the preferred method for measuring direct expenditures. Surveys normally include the following information:

- Dollars spent on expendable goods in association with a particular visit. (Expenditures are organized into specific categories.)
- Location of each expenditure (at home, en route to the site, on or adjacent to the site).
- Dollars spent on durable recreation goods in the previous year.
- Location of each expenditure (in region or outside region).
- Proportion of time each durable good was used at the recreation site being studied versus all sites where the item was used in the past year.
- Length of visit in recreation days and visitor hours.
- Major recreation activities participated in.
- Origin of visit.
- Number in party.

Currently, research is being conducted to develop standardized methods for conducting recreation expenditure surveys. A recent interagency effort known as the Public Area Recreation Visitor Survey (PARVS) used a mailback questionnaire in conjunction with onsite interviews to generate direct expenditure estimates. Table 1 shows preliminary analysis of the distribution of trip-related expenditures by major expenditure categories for visitors to five Corps of Engineers lakes. The expenditure rate (dollars per hour) includes nondurable trip-related expenditures made at home, en route, and onsite for all visitors divided by the total visitor hours spent onsite during that visit. Some visitors may not have made any expenditures in a particular category.

Table 1
Distribution of Expenditures by Visitors to Corps of Engineers Lakes (n = 673)

Expenditure Category	$/Visitor Hour
Transportation	0.63
Food	0.60
Lodging	0.40
Activities	0.11
Miscellaneous	0.22
Total	1.96

For many applications of economic impact analysis, it is necessary to evaluate the effects of a management action or change in resources on specific user groups. Table 2 compares expenditure rates between different user groups at Corps of Engineers lakes. Expenditure rates include all trip-related nondurable good expenditures. Total expenditures for multidestination trips were included. Only expenditures specifically related to the Corps project will be included in subsequent modeling efforts on multidestination visitors. Note that user groups are not mutually exclusive.

Table 2
Expenditure Rates for Different Corps of Engineers User Groups

User Group	n	$/Visitor Hour
Day user	271	3.96
Camper	331	1.76
Noncamper overnight	71	14.65
Boater	205	1.49
Nonboater	468	2.27
All users	673	1.96

Indirect impacts are measured with an economic input/output model. Many such models exist. Some are statewide models developed by state economic development agencies. Others are national models that can evaluate impacts across state lines. The PARVS project used the IMPLAN input/output model. This model is operated by the US Forest Service in Fort Collins, Colorado. The smallest unit of analysis used in the model is the county. Regions need to be defined as a single county or multiple counties. Indirect impacts are measured in a wide variety of ways. Among these are dollars and jobs that exist because of recreation expenditures. These dollars and jobs can be identified by specific sector of the economy, e.g., retail food sales.

APPROACH

The following are the steps recommended for setting up and conducting economic impact studies:

- Define the specific questions to be answered by the study. Questions can range from the evaluation of existing recreation programs to determining the economic impact of a new marina or a reservoir drawdown.
- Define the impact region to be studied. While this is usually helpful to consider at the beginning of a study, different regional models can be developed using the same survey data.
- Define the total population of visitors to be included in expenditure surveys. This can usually be done with the results from visitation surveys.
- Stratify recreation areas according to the types of visitors using them.

- Conduct expenditure surveys on a sample of visitors from each stratum (a variety of survey methods may be used to evaluate the effectiveness of each method.
- Develop expenditure profiles for each visitor group of interest.
- Construct input/output models for all projects included in the study.
- Report results.

PRODUCTS

Economic impact analysis is a method for identifying the dollars and jobs that exist as a result of recreation expenditures associated with Corps projects. Analysis may examine an entire recreation program or focus on a particular visitor group or management decision. The following are examples of how economic impact analysis can be applied to the management of recreation programs:

- Determine the economic impact of total project visitation.
- Identify the local economic effects of closing a park.
- Evaluate the effect of a particular user group (e.g. marina boaters) on the local economy.
- Determine the impact of a trade-off between user groups, such as the conversion of a day-use area to a marina.
- Identify the effect of changes in recreation resources (e.g. reservoir drawdown) on the local and regional economies.

Improving Visitation Reporting Procedures

by

M. Kathleen Perales* and R. Scott Jackson*

BACKGROUND

The US Army Corps of Engineers manages over 460 water resource projects. They have become a major outdoor recreation resource for the country. In 1963, the Corps began the systematic collection of recreation-use data. Estimates of the recreation use of these water resource projects has become essential for planning, management, and reporting purposes. In 1974, in order to meet planning needs, the US Army Engineer District (USAED), Sacramento, developed the Plan Formulation and Evaluation Studies - Recreation series. Volume two of the five-volume series deals with estimating initial reservoir recreation use; volume four describes the estimation of recreation facility requirements (USAED, Sacramento 1974).

Visitation reports are submitted monthly from Project offices to District and Division offices. Ultimately, annual reports are sent to the Headquarters, US Army Corps of Engineers (HQUSACE), and incorporated into the Natural Resources Management System (NRMS).

The "recreation day"** was the unit of measure used by the Corps since reporting began in 1963. A standard method for conducting recreation surveys within the Corps was developed (Midwest Research Institute 1979). Over the years, these reporting requirements have undergone a number of changes. These changes have been directed by the HQUSACE under the mandate of the Office of Management and Budget (OMB). In 1981, OMB directed that all Federal agencies report recreation use in the same unit of measure. An ad hoc committee was developed, and the "visitor hour"† unit of measure was selected as the standard unit of measure.

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* US Army Engineer Waterways Experiment Station, Vicksburg, MS.

** A recreation day is recreation use by one individual for any reasonable portion of a 24-hr period. Two visitors spending 3 hr boating would be recorded as 2 recreation days of use; two visitors spending one night camping would be counted as 2 recreation days of use.

† A visitor hour is the number of hours that a person spends recreating. Adapting the previous example of a 3-hr boating trip and one overnight trip into visitor hours, the two boaters would be recorded as 6 visitor hours of use and the two campers would equate to 48 hr of recreation use.

To accommodate a change in measurement units, in 1984 the HQUSACE issued Engineer Regulation (ER) 1130 2-430 (HQUSACE 1984). This regulation stated that "It is the policy of the Corps of Engineers to maintain and report accurate visitation and public use information. To insure this accuracy, recreation use surveys will be conducted at water resource projects." The procedures called for in the ER would allow the collection of information in both units of recreation days and visitor hours. An update of survey procedures was prepared by the WES and incorporated into a Proponent Sponsored Training Course (PROSPECT 1988).

Today things are still in transition, and the HQUSACE has asked the WES to develop software to produce estimates of recreation use in visits.* This unit of measure would account for the total number of people recreating at a project.

CURRENT PROCEDURES

Since 1984, many projects have used the procedures set out in ER 1130-2-430 and conducted traffic-stop surveys at their developed recreation areas. At the time of their development, the analysis programs were geared for the mainframe computer environment. Many projects opted to modify data fields to collect additional information. The WES produced a total of 12 different computer programs to edit, analyze, and report traffic-stop survey data, to accommodate field requests.

At many District offices, data management tasks associated with the surveys were enormous. Consider, for example, a single project with 30 traffic meters and four survey seasons. In this example, 120 weeks of survey data would be collected, each week of data representing an aggregate weekday and weekend day sample. Multiply this by 10 or more projects within a District, and it is obvious that many District personnel were overwhelmed by information. Personnel turnover and the need for mainframe experience added to the size of the task.

Analysis procedures were cumbersome, and data from survey forms had to be keypunched and run through an edit program. Corrections from the edit program had to be incorporated into the data file. The cleaned data structure was then run through the analysis program producing load factors.** The weighted results produced by this program then had to be transposed and keypunched into another data structure (reports structure). This new reports data structure contained the information required to convert raw traffic counts into estimates of visitation. This report structure was then run through

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* A visit is a count of persons on the project for the purpose of recreation. In our example, the two boaters (2 recreation days, 6 isitor hours) would be reported as two visits; likewise, the two campers (2 recreation days, 48 visitor hours) would also be two visits.

** Load factor is the term used to describe the weighted results that are applied to traffic device counts to translate counts into visitation. Load factors would include weighting, such as percent of all traffic that is recreation related, average axle count per vehicle, average number of people per vehicle, etc.

the third mainframe program (the reports program) to produce monthly estimates of use. Monthly reporting was accomplished.

IMPROVED PROCEDURES

The advances in computer technology since 1984 have made mainframe programs obsolete. The advent of desktop computers has created an environment that reduces the cost and time required for analysis. Day-to-day use of desktops has increased the microcomputer skills of project and District staff. The more powerful laptop computers make it feasible to collect information more readily, reducing data entry problems. The WES is currently revising the procedures and adapting the traffic-stop surveys for the laptop and microcomputer environments.

Figure 1 illustrates the proposed outline of the menu-driven visitation estimation and reporting system. Traffic stop survey data can enter the system either from existing keypunched files (identical to the mainframe data structure) or from a direct data entry system. If the direct data entry system is used on a laptop computer in the field, editing is nearly eliminated. The direct data entry system screens entries for logic and range errors.* The edit program will remain available for data structures that were keypunched from paper forms and require additional attention.

The analysis program that produces the load factors will also produce the data file structure required for the reporting program, thus eliminating keypunching. Users of the microcomputer system will be able to easily transfer load factors developed for surveyed areas to areas not surveyed but included in reporting. Load factors transferred in this way will be identified as coming from surveys conducted at other sites. Users will also create data files that identify which seasonal load factors will be applied to each monthly visitation report. In addition, for each monthly report run, a backup file is created with year-to-date totals that can be carried forward, a process that on the mainframe had to be updated monthly. In the menu-driven environment, processes that were previously done by keypunchers and programmers are now performed by the software, reducing the data management burden.

The final version of the reporting structure is still in process, but it is anticipated that visitor hours and visits for camping and day use will be the reporting fields of the future. Total visits will also answer the long-asked question, How many people were out there?

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* An example of a logic error would be a person recorded as a day user with 4 nights of camping. A person is either a day user or a camper; a visitor cannot logically be both. An example of a range error would be an entry of three people in the car and five people boating; the number 5 is out of range.

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US Army Engineer District, Sacramento. 1974. "Plan Formulation and Evaluation Studies – Recreation, Estimating Recreational Facility Requirements," IWR Research Report 74-R1, prepared for US Army Engineer Institute for Water Resources, Fort Belvoir, VA.

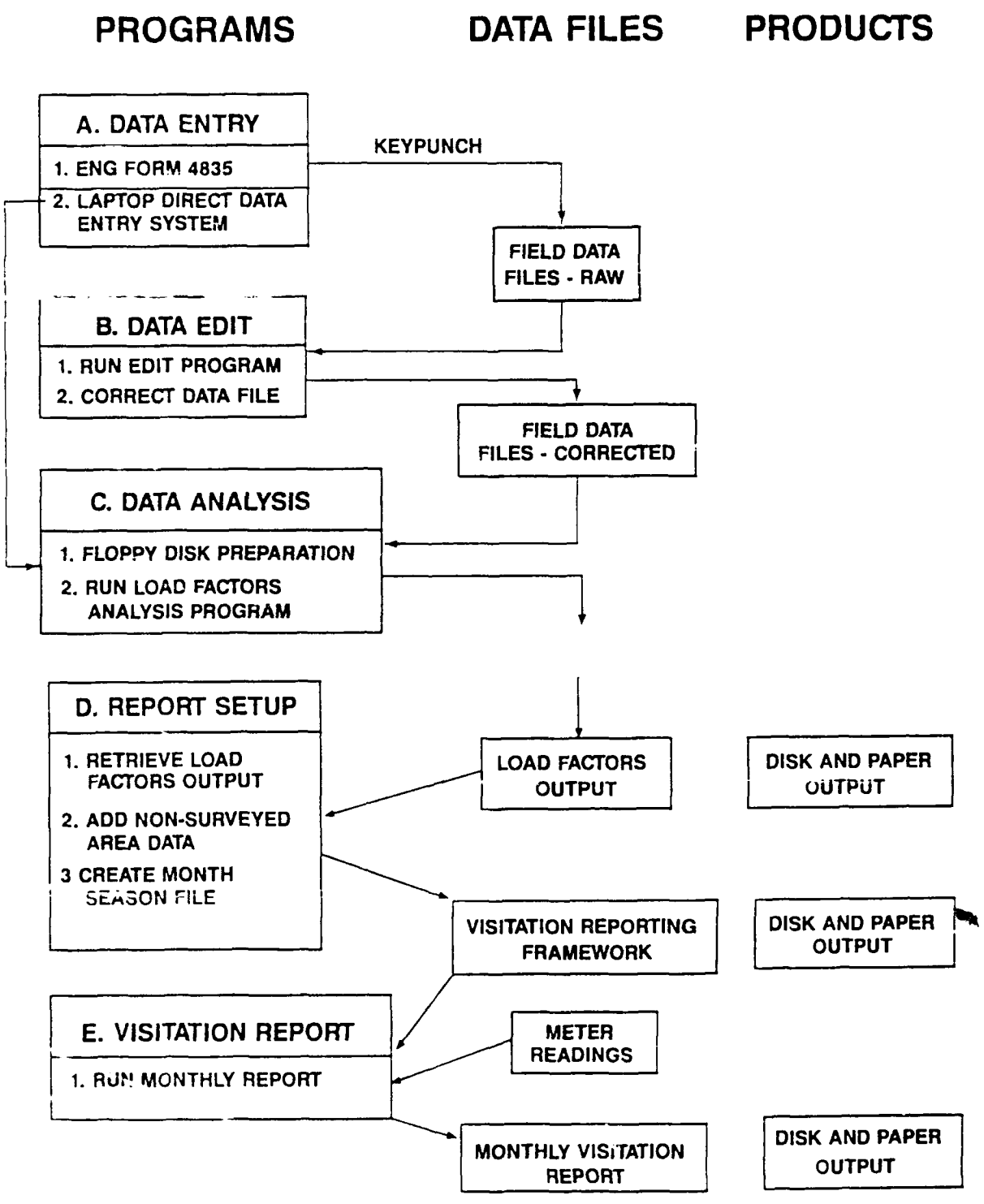

Figure 1. Menu-driven system for recreation-use data analysis

Techniques To Estimate Dispersed-Recreation Use for Corps of Engineers Lands

by

M. Kathleen Perales*

INTRODUCTION

Visitation at Corps of Engineers (CE) projects can occur in developed recreation areas and on undeveloped lands. Developed recreation areas include all designated parks on Corps-managed lands where recreation facilities are maintained. These facilities can be under the management of the CE or may be leased to local, state, or Federal agencies or quasi-public organizations. Undeveloped lands that provide opportunities for dispersed-recreation use include all lands inside the project boundary but outside of designated parks, where few or no facilities are provided or maintained. Such lands may be leased as described above or managed by the CE.

Visitors gain access to developed and undeveloped project lands by using a vehicle or by walking. Currently, the CE only monitors recreation use associated with vehicular access to developed recreation areas. This visitation is monitored through the use of "traffic-stop" surveys tied to traffic-metering devices. In this procedure the visitor is stopped while exiting a recreation area and is interviewed (PROSPECT 1988). The results of the surveys are tied to traffic volume estimates obtained from counters in the area. However, this procedure only provides estimates of use for areas that have controlled access and are suited to the limitations of traffic-counting devices.

For many CE lakes, recreation in developed areas represents only a portion of the total visitation occurring on a project. Traffic-stop surveys are inappropriate for use-estimation in situations where visitors walk into developed areas to recreate or where visitors drive or walk to undeveloped sites. This visitation will be referred to as "dispersed-recreation use" for the purposes of this paper.

Previous studies conducted by other agencies (e.g., the US Forest Service) have estimated visitation in dispersed-use settings by sampling visitors as they enter or exit via a roadway (James and Henley 1969), a trailhead (James and Schreuder 1972), or a launch site, or as they pass a segment of a waterway (Marnell 1977). While the techniques used in these studies are appropriate in these settings, they may be inappropriate at many CE projects due to the nature of the recreational-use patterns. Unlike use identified in these studies, the dispersed use associated with many projects is not limited to well-defined areas such as trails or segments of a waterway. Visitation is characterized by noncontinuous use of a narrow band of shoreline around a reservoir and small parcels of undeveloped land. Of particular significance is recreation use

* US Army Engineer Waterways Experiment Station, Vicksburg, MS.

associated with residential development adjacent to CE projects and use of wildlife management areas and other lands with numerous access roads.

Use-estimation procedures for these visitors require a different surveying strategy based on the geographic distribution of the user group and the method of access to the resource. Figure 1 illustrates the resource settings, methods of access, user groups, and appropriate sampling techniques as they apply to CE settings.

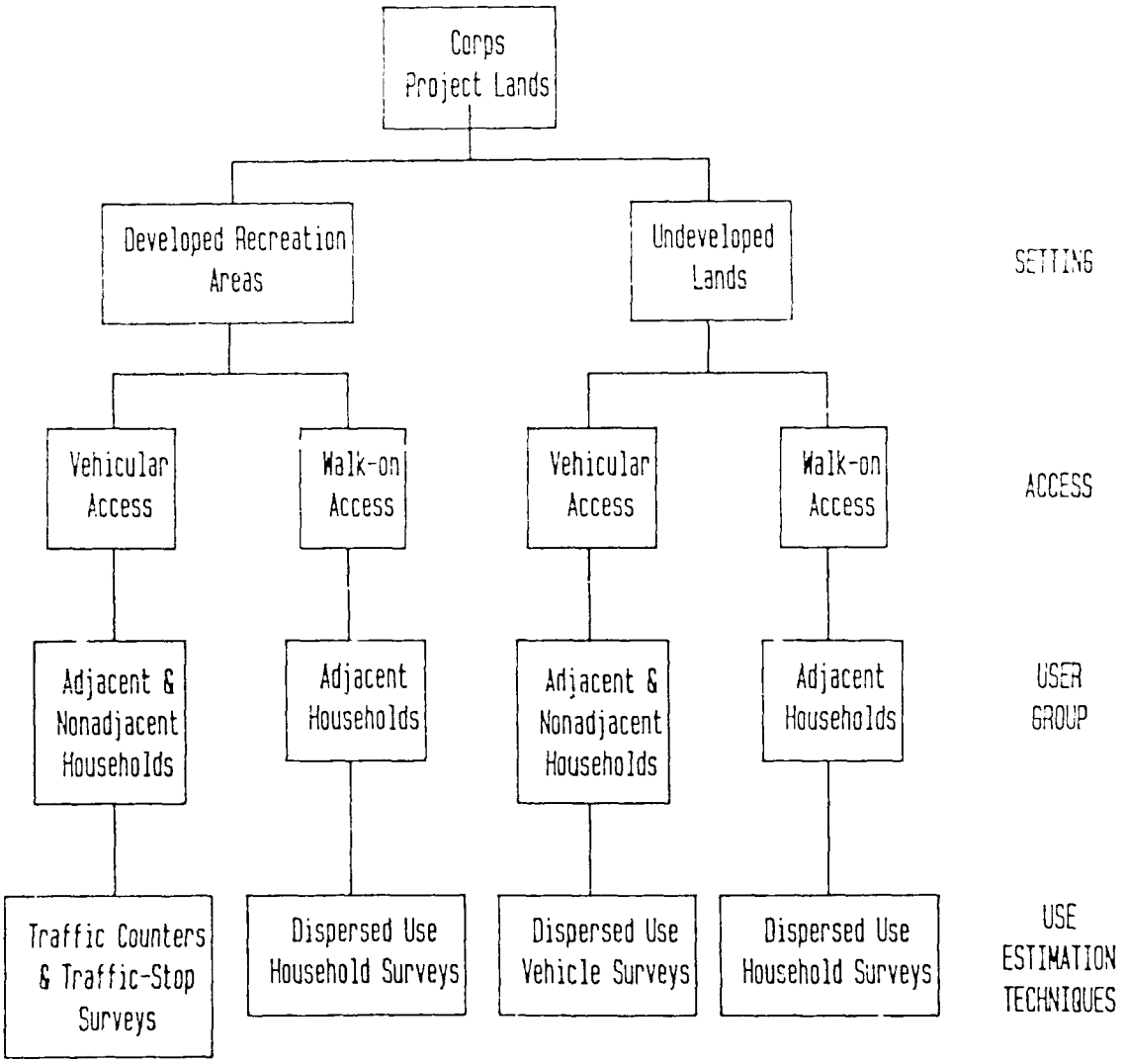

Figure 1. Techniques for estimating recreation use of Corps lands

APPROACH

Because of the diversity of the resource setting, the method of access, and the user groups, separate techniques for estimating walk-on and vehicular access use were needed. To distinguish these two techniques from the traffic-stop survey, they have

been given names that reflect the mode of access and user group. The technique used to estimate the number of visitors that drive to areas that cannot be monitored by traffic-metering devices is called the vehicle access survey. The survey technique used to measure the number of visitors that walk to undeveloped areas and undeveloped lands from their home is called the household survey.

Vehicle access survey

The Waterways Experiment Station (WES) has worked with the St. Louis, Pittsburgh, and Wilmington Districts to develop and test the vehicle access survey technique. The test project at John H. Kerr Reservoir, Wilmington District, served as the most extensive of the testing efforts. Although field test summaries have not been completed at this time, a report is planned that will outline the procedures and highlight current findings.

Application. The vehicle access survey is suited to those projects having a substantial amount of drive-on use occurring outside the developed recreation areas. Unlike the traffic-stop surveys, this survey must provide data not only for use activities but also traffic volume estimates. Due to the extensive roadway networks that allow users to park in a variety of locations and disperse to recreate, surveys cannot follow the face-to-face interview format of the traffic-stop survey. In addition, the lack of the traffic counter forces an independent volume estimate.

For many projects, this type of use is seasonal in nature and typically runs opposite of visitation in developed recreation areas. Typical seasons and activities of use suited for this technique include spring fishing and fall hunting seasons. The primary lands suited for this technique include wildlife management areas and other project lands with significant use and unlimited access to vehicular traffic.

Procedure. To estimate the amount and type of dispersed-recreation use associated with undeveloped lands, information concerning historic dispersed traffic patterns must be obtained. All jeep trails, road ends, and other access points are identified. Corps project lands are then categorized into zones that can be traveled by an interviewer, visiting each access point identified at specified intervals. Visitors that drive to these undeveloped lands to recreate are identified or "tagged" by the location of their parked car, and a questionnaire is left for the occupants to complete.

For a given survey season and a randomly assigned zone and day, a surveyor drives through all of the zone's access points, leaving mail-back questionnaires with each vehicle. In addition, the surveyor notes pertinent information about the vehicle, location, and time. The returned questionnaires are then analyzed and expanded to produce estimates of use.

Discussion. The format of the mail-back questionnaire allows the visitor to report recreation use as well as answer resource and management questions associated with their visit. Data on length-of-stay and number-in-vehicle provide necessary information for use estimates, while information on use (such as number of animals harvested) provides data on wildlife management concerns. Data recorded at the time of the survey distribution provide information on nonresponse and repeat use.

From a Lake Shelbyville sample of opening day upland game hunters, it was found that the average recreator stayed 4.86 hr, while 2 hr was the most common length-of-stay. This particular user group was also highly mobile. These factors helped determine that 2 hr should be the time recommended to circulate through the zones. Any time longer than 2 hr would allow too many of the visitors to enter and leave the area before the questionnaire could be distributed, creating sampling bias. Additionally, because of user mobility, the reporting of area use levels created reliability problems. If zone (or area) information was required, a much greater effort in sampling would be necessary. Project-level information, which is required for reporting purposes, can be obtained with a much smaller sampling effort than for zone-level information. Additionally, response and data reliability are considered to be improved for project-level data because of the lower impact to repeat users.

Household survey

The WES has cooperatively worked with the Tulsa and Savannah Districts to estimate the dispersed recreation use associated with households adjacent to CE project lands.

Application. The household survey is suited to those projects having a significant amount of recreation use contributed by residents of households adjacent to project lands and their guests. Visitors may walk to developed recreation areas or undeveloped lands to recreate. Many of these visitors have an access advantage, because they have boat docks or share a boundary with the the Corps. Due to their advantage of location, these visitors seldom drive to recreate.

The survey must provide data on use and activities for this user group, but the estimate of total volume of use is directly tied to the total number of households and sampling days under study.

Because of the vast amounts of shoreline that may be affected by this type of use, it is unrealistic to conduct onsite interviews with the visitor. Instead, a sample of households, representing the mix of households in the population, is interviewed and asked to become part of a panel. As a member of the panel, the household is called periodically to determine the amount and type of recreation that can be attributed to the household. From these data, total recreation use can be estimated by extrapolating use estimates to the total number of households in the population.

Procedure. Because the composition of households around a project is the focus of dispersed walk-on use, an inventory of the total number of households is required. An initial count of households grouped into categories of permit and nonpermit households also must be obtained, since one of the assumptions in this survey design is that boat dock permit holders may recreate at a different rate than nonpermit households. Another assumption is that seasonal residents and permanent residents may not recreate at the same rate. Although it is nearly impossible to categorize seasonal and permanent households a priori, sample sizes are kept at a level sufficient to ensure that minimum sample sizes in each group are maintained.

Once all household groups in the study are counted and categorized (typically on aerial photographs), a random sample of households within each class is selected. A

profile interview is then conducted at each household, at which time the household members are asked to become part of a panel. Should a household refuse to become part of the panel, the profile will provide information on nonresponse bias, and a replacement household is sought. The panel household will be called periodically and asked about their use and any guest's use of project lands for the 2 days preceding the call. The information from the telephone surveys is then analyzed and expanded to produce estimates of use.

Discussion. The format of the telephone survey allows for collection of visitor-hour data without a reporting burden (e.g., diary) on the household. Data on length of stay for household members and guests provide the necessary information for use estimates.

Table 1
Composition of Panel Members for Lake Texoma Household Survey

	Sample Households		
Category	Permanent	Seasonal	Total
Permit	39	72	111
Nonpermit	130	84	214
Vacant			10
			335

At Lake Texoma, Tulsa District, a total of 335 households comprised the panel of residents representing over 6,000 houses. Recruitment was begun and completed during the summer season (June-August) of 1986. The probability of finding seasonal residents during this time was considered to be higher than during nonpeak seasons. Only 12 refusals were encountered by the interviewers during the summer. Table 1 outlines the panel composition. Table 2 provides the initial estimates of use for each of the four seasons surveyed. While seasonal averages are presented in Table 2, Table 3 illustrates the distribution of use within the classes of households sampled for a single season. Additionally, the population of households around Lake Texoma is primarily composed of households without boat dock permits, thereby weighting the estimates appropriately. The profile of the panel representing the residents around Lake Texoma can be described as white (97 percent), well educated (43 percent having gone to college), and older (over 30 percent over the age of 60). Use patterns of other populations may vary significantly.

Data for a full year have been collected at Hartwell Lake, although the telephone survey analysis has not been completed. Unlike Lake Texoma, Hartwell Lake has a very narrow band of land around the water's edge. The households under study are all adjacent boundary owners with a good share (70 percent) having private boat docks. The profile of this panel is characterized by a younger population (21 percent over

60 years of age), with close to 50 percent with some college-level education, and 99 percent white. Similarities and differences between this population and Lake Texoma's need to be evaluated in the future.

Table 2
Lake Texoma Visitor-Hour Estimate per Household and per Season

Season	Per Household per Day	Seasonal Estimate	Seasonal Estimate Standard Error
Spring (March-May)	1.85	1,027,400	86,000
Summer (June-August)	3.07	1,701,606	195,000
Fall (September-November)	0.92	504,310	64,000
Winter (December-February)	0.46	249,754	41,000
		3,483,070 (2% of total project use)	

Table 3
Lake Texoma Visitor Hours per Household per Day for Summer Season (June-August)

Household Stratification	Average Visitor Hour per Household per Day
Permanent with permit	5.34
Permanent nonpermit	2.49
Seasonal with permit	2.85
Seasonal nonpermit	3.86
Seasonal average	3.07

SUMMARY AND CONCLUSIONS

In the past, emphasis has been placed on estimating use associated with vehicular access to developed recreation areas. At some projects, however, substantial use occurs that does not meet this definition. Until this time, standardized techniques have not

existed for these other types of uses. This lack has been addressed by the WES with the development of the vehicle access and household survey procedures.

These new procedures will allow projects to answer wildlife management questions, address resource allocation questions, and identify the recreation use and impacts of area residents. Standardization of the procedures means that the survey process will be more cost effective and timely, hence available for use by a greater number of projects. In addition, standardization ensures that the data collected at each project are consistent and comparable.

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An Approach for Modeling Recreation Use at Corps of Engineers Projects

by

Herman Senter* and R. Scott Jackson**

INTRODUCTION

Outdoor recreation is a significant function of many Corps of Engineers (CE) projects, both in terms of resource requirements and benefits to the public. The need to plan for recreation use, manage it efficiently, and estimate benefits from recreation programs is evident, particularly in instances where recreation demands conflict with other project functions. The results of models that predict recreation behavior can provide useful information for both current and planned projects in:

- Estimating recreation demand and predicting the type and level of use.
- Allocating resources to meet recreation needs.
- Evaluating alternative resource allocation policies.
- Measuring current and potential benefits to the public.
- Controlling and directing recreation use.

The purpose of this paper is to present a general approach for improving the recreation demand modeling capabilities within the Corps.

FACTORS AFFECTING RECREATION USE

Recreation demand modeling is used primarily to predict the amount and type of recreation use that can be expected to occur under a variety of conditions. The factors that influence recreation use at CE projects can be subdivided into three categories:

- Management actions, such as the imposition of user fees or restriction of certain types of activities.
- Natural or man-induced changes in natural resources (e.g., fluctuation of pool elevation or changes in water quality) which change the suitability of the resource for certain types of recreation activities.

* Clemson University, Department of Mathematical Sciences, Clemson, SC.

** US Army Engineer Waterways Experiment Station, Vicksburg, MS.

- External changes, such as changes in recreation preferences, economic factors, and other societal changes. Examples of these types of factors include the emergence of a new recreation activity, such as sailboarding; significant changes in fuel prices; and increases or decreases in population.

APPROACH

Modeling recreation use depends on being able to understand the relationships among the factors that affect use and to express these relationships in mathematical terms. At least a partial understanding of historic recreation use patterns can be obtained through the use of CE visitation data. These data, routinely collected at existing CE projects, include types of recreation activities, length of stay, and origin of the visitor. However, most of these data are from large reservoirs and navigation projects operated by the Corps and may be of limited use in developing predictive models for CE projects to be constructed in the future or for projects constructed by the Corps and operated by other agencies. The limitations are caused by dissimilarities in the facilities and recreation activities associated with the different types of projects. For the types of projects likely to be constructed in the future (beach nourishment projects, levees, jetties, and small local flood protection projects), recreation use statistics and patterns are scarce. Special attention needs to be given to the modeling information requirements for these types of projects.

The array of factors that influence recreation use patterns and the interrelations among the factors are not well understood, much less quantified. Existing models are gross simplifications of a complex phenomenon, their form dictated largely by the availability of data. However, even with these shortcomings, the current generation of models serves a useful role in meeting the needs for quantitative and defendable estimates of recreation use and economic benefits.

Advances in recreation demand modeling may be achieved in a variety of ways. These include the improvement of existing models (e.g., hybrid gravity models), development of new methodologies (e.g., multinomial logistic regression models), and quantification of specific factor effects (e.g., modeling the effect of water level changes). Advances may also be made simply through a better understanding and utilization of current technology, either by historical validation studies or by improved information exchange.

The approach for improving the CE capability in recreation demand modeling will include three components:

- Identification of long-term modeling applications based on user needs.
- Development of specific studies that improve the accuracy and applicability of existing models to meet CE needs.
- Promotion of wider application of modeling by simplifying the process of using models and increasing the technical support available to potential users.

Recent Developments in Campground Receipt Study Data Collection

by

John P. Titre,* Janet Akers Fritschen,*
R. Scott Jackson,* William A. Rogers*

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 four areas of that effort: (1) the importance of an ongoing database, (2) a description of the Recreation Research and Demonstration System (RRDS), (3) an outline of the study's procedural development, and (4) a discussion of innovations for data entry and output that are both efficient and useful for decision-making.

IMPORTANCE OF A CAMPING DATABASE

It is first necessary to ask, Why is an ongoing database important to recreation management, and how can it be used to improve decision-making? A useful example of a database application occurred in the campground industry during the early 1970s. Many agency planners misinterpreted the effect of a decrease in recreation vehicle (RV) shipments in relation to increased automobile fuel prices. During the 1973-74 energy crisis, RV shipments decreased by 41 percent (Cole and LaPage 1980). Since campers using RVs have a longer length of stay than tent campers (16 days per year versus 9 days), it would seem that campgrounds that cater to RV units should have experienced lower use levels than normal. Yet to the surprise of planners, use levels remained relatively unchanged during this period according to an unpublished US Forest Service document by the same authors. Without data on the amount and types of past use, there would have been no way of evaluating the effect of low gasoline availability on recreation use.

Application of an ongoing database resulting in trends contains many strengths and weaknesses. Since a trend refers to the systematic observance of something over time, analysis can be hampered by the lack of comparability of survey questions and sampling methods (National Academy of Sciences 1975). Additional limitations include a lack of standard definitions for measuring social indicators and differences in the level of detail for gathered data. One particular strength of an ongoing database is that it enables researchers to test different procedures for collecting the same data. To ensure reli-

* US Army Engineer Waterways Experiment Station, Vicksburg, MS.

ability, a database should contain data collected over a period of time long enough to avoid cycles while accounting for short-term variations.

RECREATION RESEARCH AND DEMONSTRATION SYSTEM

The Recreation Research and Demonstration System 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 465 Corps projects. The projects were chosen to characterize multipurpose reservoirs, locks and dams, and dry lakes. Specific criteria for selection were as follows:

- Full range of activities
- Spectrum of resource characteristics
- Distribution of units nationwide
- Range of conditions at multiple-purpose projects
- Typical planning, design, and management tasks

A WES 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; and camping parties with vans, cars, motorhomes, trucks, tents, pop-up trailers, pickup campers, travel trailers, and powerboats. An examination of variables, such as the use of electrical hookups, can assist managers in planning for visitor preferences.

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

	PROCEDURES	TRENDS	APPLICATIONS
REPORT 1	DEVELOPMENT OF DATA COLLECTION PROCEDURES	---	
REPORT 2	DISCUSSION OF POTENTIAL USES	---	
REPORT 3	FORMS EVALUATED AND IMPROVED	KEY VARIABLES REPORTED	---
REPORT 4	FORM FINALIZED	BROAD TRENDS IDENTIFIED	INITIAL APPLICATIONS
REPORT 5	---	TRENDS EXTENDED	VISITOR ORIGIN APPLICATIONS
REPORT 6	---	TRENDS EXTENDED AND EVALUATED	PROJECT USER PROFILES
CURRENT REPORT	---	TRENDS EXTENDED INCLUDING GOLDEN AGE TRENDS	OCCUPANCY RATE ANALYSIS
FUTURE	DEVELOP AUPS/CRS INTERFACE	TRENDS EXTENDED	MICROCOMPUTER ANALYSIS DEVELOPED

Figure 1. Campground Receipt Study, system development

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. Recently, Nolin Lake, Kentucky, used 2 years of data to examine the effects of increases in user fees on the amount and distribution of use. Staff at Greers Ferry Lake, Arkansas, and the Louisville and Pittsburgh Districts have used the information to evaluate current and potential usage of electrical hookups. Zip code data have been analyzed by the Lake Oahe staff to determine county of origin for their visitors. These data have also been used to prepare marketing information for the Little Rock District. Finally, the staff at Lake Shelbyville referred to sales data in planning and preparing visitor information brochures.

Additional uses of CRS could include an examination of occupancy rates. 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 USES OF 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 for analysis and reporting of campground information. The development of the Automated Use Permit System (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 keypunching and [illegible] and provides some onsite 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 or to improve the efficiency of operating and maintaining campgrounds. These data are useful to landscape architects and planners when examining future recreation area designs. For example, District planners can examine key variables such as occupancy rates across projects since CRS data are gathered with the same methods.

SUMMARY AND CONCLUSIONS

Investment in the CRS effort is beginning to reap the dividends of continual development. Nearly 8 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 use of Corps areas. This AUPS/CRS combined system has been shown to improve overall efficiency and can address current problems by giving resource managers better control over a constantly changing environment.

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Operational Management Plans: Status, Content, and Implementation

by

Michael R. Waring,* Linda D. Peyman-Dove,* and John P. Titre*

INTRODUCTION

This report is part of the Natural Resources Management and Planning Work Unit (No. 32503), funded under the Natural Resources Research Program. One of the initial concerns of the work unit is the development of Operational Management Plans (OMPs). The objective of this task is to better understand the current status, content, and implementation of OMPs by District and Project personnel. An understanding of the existing situation can facilitate measures to both enhance adoption of OMPs and increase their effectiveness toward improving Project operation and District coordination. To the extent that OMPs function as a desktop reference available to all parties responsible for operational management, decision makers can be better informed of the basis for actions necessary to ensure successful project operation.

This document is a summary of selected questionnaire results from Corps District Operations Divisions and Project offices. It is intended to provide insight on the following objectives and to determine how many Districts and Projects are developing OMPs for effective management of the project. Specific objectives were to:

- Determine the current status of OMPs from a representative sample of Corps Districts.
- Identify the major topical components of existing OMPs.
- Determine the current level of implementation based on selected effectiveness criteria.

The results presented herein represent a portion of the ongoing work being conducted under this work unit; more detailed coverage will be available in a WES Miscellaneous Paper currently under review. As an extension of this report, we are reviewing existing OMPs to determine how the OMPs are being developed, what information is needed, and how the information is being used for effective management.

RELATIONSHIP TO OTHER RESEARCH

This work unit is directly related to a number of other research efforts, both past and future. It is a direct extension of the Resource Capability Study completed for the

* US Army Engineer Waterways Experiment Station, Vicksburg, MS.

Headquarters, US Army Corps of Engineers (HQUSACE), and draws heavily upon lessons learned in the Fort Benning Land Use Planning Study. Proposed work units (as shown in Figure 1) are related to this work in that they represent questions of importance, either as tools for completing the OMP or as major management elements addressed in the OMP.

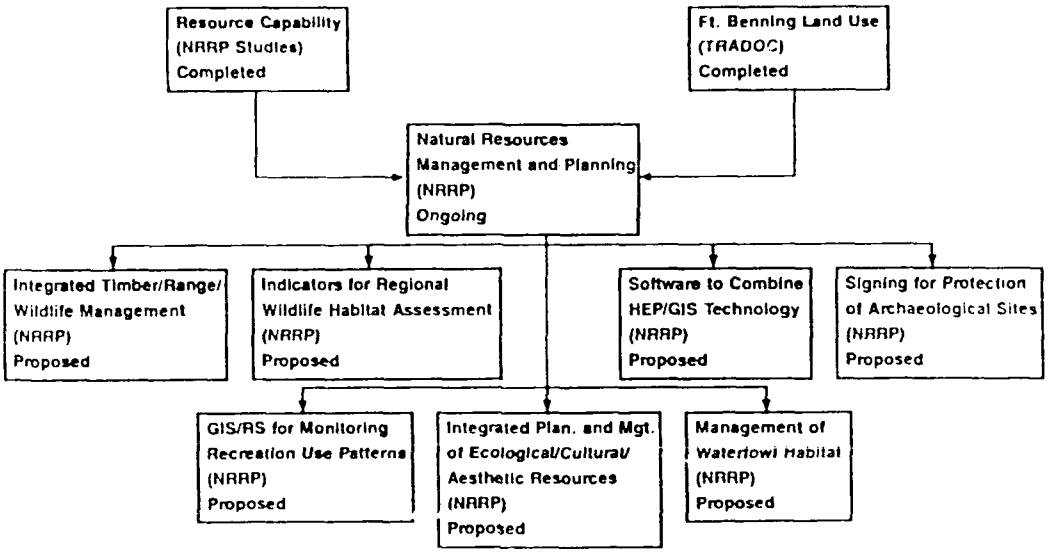

Figure 1. Relationship to other work

METHODS

A questionnaire was mailed to 27 Operations Divisions within Corps Districts and 2 Project offices. Of the 29 questionnaires that were distributed, 26 were returned, yielding a response rate of 89.7 percent. Although no follow-up mailings were conducted, telephone calls were made 10 days after the requested mail-back date. Throughout the report, percentages will be based on the number of responses to each question (i.e., n = number of responses). District personnel were asked to select a "representative" project OMP and to base their answers to the questionnaire on that OMP. Subsequent telephone conversations with District personnel indicated a tendency to share the best, only, or most complete OMP, regardless of representativeness. These plans may eventually serve to guide the Districts in completing or improving their unfinished or anticipated plans. It has been observed in the technology transfer literature* that implementation of an institutional idea often follows the lead taken by innovators within the organization.

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* J. A. Jolly, J. W. Creighton, and P. A. George. 1978. "Technology Transfer Process Model and Annotated Selected Bibliography," 54-CF 780901, Naval Postgraduate School, Monterey, CA.

FINDINGS

The findings in this report are organized according to research questions. These are used to group the questionnaire results; in some cases they are directly from the questionnaire, while in other cases they may combine questions from the questionnaire. This facilitates a quick reference to those items of interest to a particular audience (e.g., HQUSACE, District, or Project) and enables a discussion of how these findings relate to the improvement of OMP progress in the Corps.

What is the current status of OMPs Corps-wide?

The Corps has 398 projects that require an OMP, based on the sample (n = 26). Figure 2 illustrates the completion status of these OMPs, which are divided into six categories: complete, under review, under revision, being written, planned, and not anticipated.

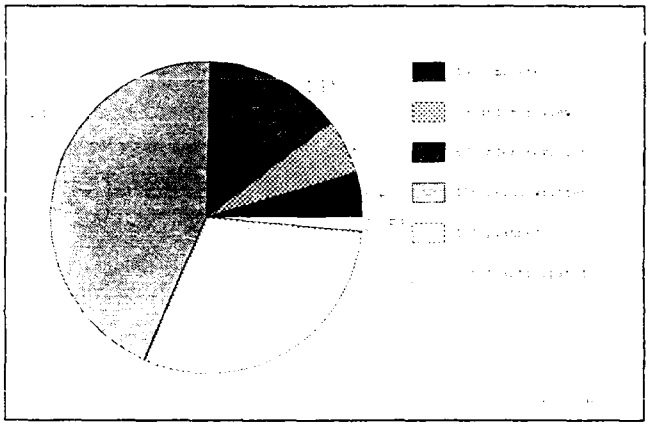

Figure 2. Current status of OMPs

Only 5 percent of the OMPs are complete. However, 20 percent are either under review or revision. Several respondents stated that, although their OMPs are not yet approved, they are currently using the annual work plan. Furthermore, District personnel commented they are spending their initial time preparing a prototype OMP that can serve as a guide for other projects. This is especially true for those Districts that are responsible for numerous OMPs.

What is the anticipated status of OMPs by 1990?

District personnel were also asked to provide an approximate date for completion of OMPs. Figure 3 shows that, by 1990, respondents predict that approximately 85 percent of the OMPs will be complete (n = 23). In comparing Figures 2 and 3 it is clear that, based on reported answers, nearly all OMPs will be completed within the next year or two. This should be viewed with extreme caution; available time, money, manpower, and the requirements of other projects probably make this more of a "wish list" than a

reality. Also, even if this schedule can be met, the quality, depth, and utility of these OMPs may vary considerably.

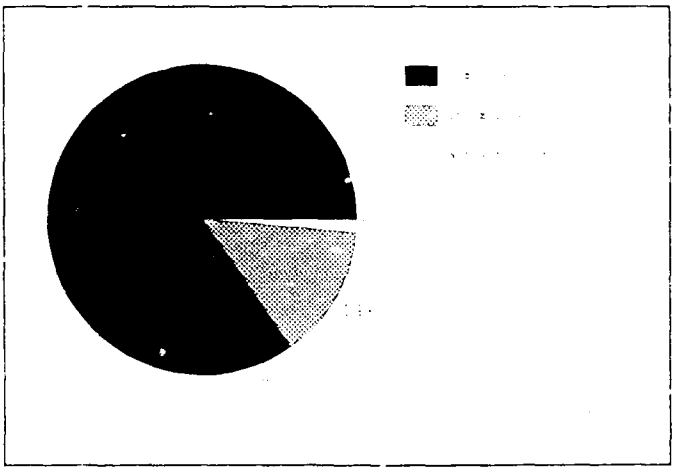

Figure 3. Projected status of OMPs

Who is involved in preparing the OMP?

Producing an OMP generally requires input from both Project and District personnel. Figure 4 shows the distribution of percentages of types of Project personnel, by job title, preparing the OMP (n = 25). The "other" category includes biologists, foresters, landscape architects, engineering technicians, and miscellaneous temporaries. In general, park rangers spent a greater amount of their time on OMP preparation than either park managers or personnel in the "other" category.

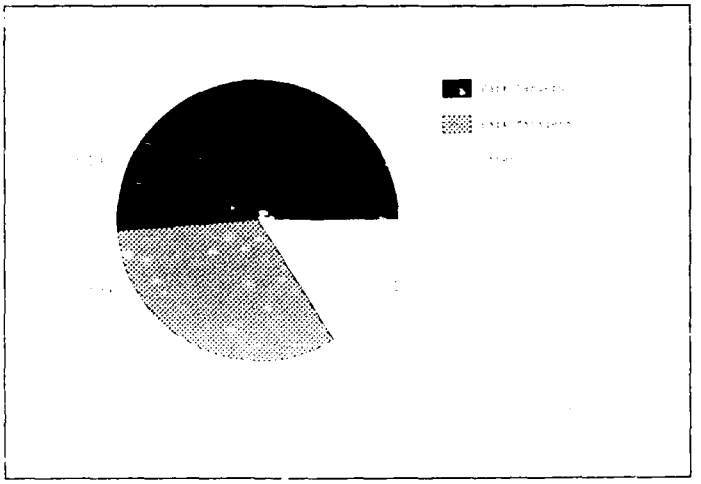

Figure 4. OMP preparation - Project personnel

Figure 5 illustrates the percentage of personnel involved in the preparation and review of the OMP at the District level (n = 25). Overall, personnel at the District level spent a lesser amount of their time during preparation of the OMP than the Project personnel. According to the responses, District and Project offices usually produce an OMP as a joint effort. This effort often begins at the Project; however, Project personnel may not always have the time to work on the OMP, as noted from the questionnaire results.

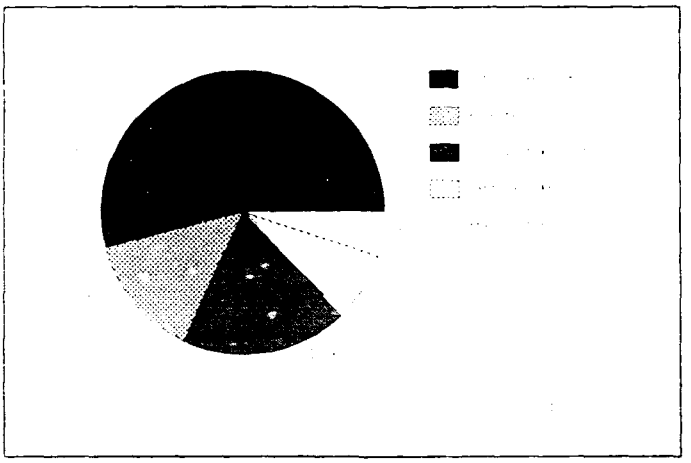

Figure 5. OMP preparation - District personnel

How complete do Project personnel consider their resource inventories?

Respondents were asked about the completeness of their inventories on a scale of 1 to 5, with 1 representing nonexistent and 5 representing very complete. Although some misinterpretation may exist as to the meaning of these terms, responses provide a relative measure of the emphasis assigned to individual categories.

Figure 6 shows that progress has been made in all inventory categories (n = 22). The recreation and soils inventory data appear to be the most complete.

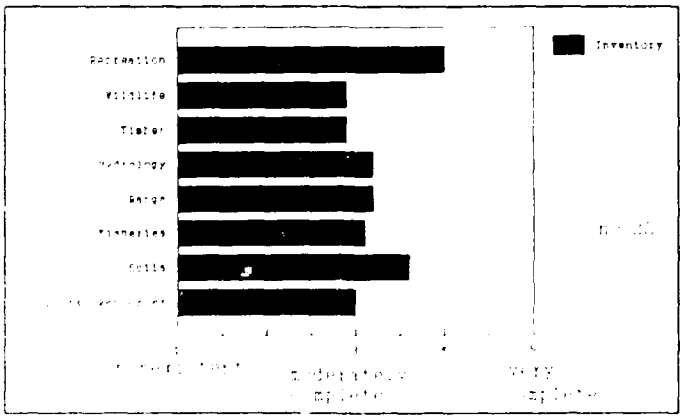

Figure 6. Completeness of inventories

What are the major methods of reporting and analyzing resource inventories?

Approximately 50 percent of the projects reported they use only narrative descriptions to analyze and report resource inventories (n = 22). The remaining 50 percent use various combinations of narrative descriptions, manual overlays, database management systems, and Geographic Information Systems (GIS).

How many Operations Divisions use a GIS for OMPs?

Only three Operations Divisions (n = 25) within the Corps Districts have either a GIS or access to a GIS and are actively using it to produce an OMP. Three other Districts indicated their District has a GIS, either in Planning or Engineering Division; however, comments indicated Operations Division is not involved with the use of these systems. Omaha District is the only District planning to implement a GIS at a Project office (Lake Oahe) in the immediate future (March 1989). The Vicksburg District stated that it had ordered a GIS, which will be delivered shortly, with satellite systems being procured for each Project office, compatible with the District system. Several Districts indicated they are interested in GIS and are studying the possibility of purchasing a system, while other Districts indicated a lack of familiarity with and knowledge of how a GIS would be used.

Do the Projects need any guidance in preparing an OMP?

Respondents were asked about the type of guidance needed from three levels within the Corps and three methods of instruction. Figure 7 shows that institutional guidance seemed to follow the chain-of-command contacts, with District guidance needed more than that of the Division and HQUSACE (n = 22). Nearly 75 percent felt that a workshop would fulfill guidance needs.

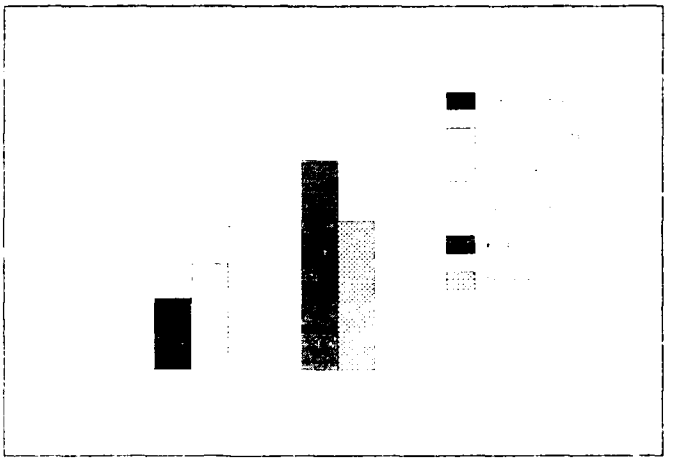

Figure 7. Guidance and training

SUMMARY

Four areas of the OMP process emerged from the questionnaire as needing some improvement.

- Outlines (content)
- Writing better management objectives
- Designing resource inventories
- Monitoring recreation and resource conditions

Each of these may have significant management implications and will be examined in more detail. As we continue with this project in the future, selected OMPs will be reviewed in light of these implications to develop a model plan. This will result in a set of guidelines that can be used to formulate new OMPs and to improve existing OMPs.

PROPOSED FY90 NEW STARTS

A Framework for Assessing the Quality of Boating Conditions on Corps of Engineers Lakes

by

R. Scott Jackson* and John P. Titre*

INTRODUCTION

People engage in recreational activities such as boating to fulfill unmet needs. Natural resource settings such as lakes and rivers provide places for boaters to interact with others and the outdoors. These settings possess environmental attributes that require active management to ensure that the resource is used without degradation and that quality experiences can be maintained. The challenge for resource managers is to facilitate the interaction between what people are looking for (need fulfillment) and where they can find it (resource settings). This responsibility occurs within the limitations of a fixed resource base as greater demands are placed on the recreational use of lakes and rivers.

The purpose of this paper is to characterize the problem of managing boating resources, especially on Corps lakes, and to offer a framework for improving boating and other watercraft use conditions.

Specifically, the overall research objective is to develop methods of maintaining high-quality boating opportunities while responding to increasing use.

This approach recognizes four tasks that when incorporated with input from managers and the public provide a guiding framework for addressing the management of boating and related recreation use. These tasks are to

- Develop methods of monitoring boating conditions.
- Evaluate effectiveness of conflict resolution techniques.
- Provide guidelines for determining optimum and maximum use levels.
- Identify regional approaches for managing boating opportunities.

DEMAND FOR RECREATIONAL BOATING

Over 20 years ago the President's Outdoor Recreation Resources Review Commission (ORRRC 1962) stated that "Water is a focal point of outdoor recreation--most people seeking outdoor recreation want water--to sit by, to swim and to fish in, to ski

* US Army Engineer Waterways Experiment Station, Vicksburg, MS.

across, to dive under, and to run their boats over." This American legacy of the need to enjoy water is evident in the ever-increasing number of boat sales each year. In 1987, approximately 750,000 new boats were sold nationwide (National Marine Manufacturers Association 1988).

Regional sales patterns may exhibit even greater proportional increases than the national average. For example, in responding to a recent technical request to examine boating conditions at Falls Lake, North Carolina, we found that approximately 70 percent of all boaters had been boating 15 years or less. The population growth of Raleigh, North Carolina, combined with the recent construction of Falls Lake partially explains a near doubling of demand for water-based recreation.*

QUALITY IN WATER-RELATED RECREATIONAL USE

Recreation quality, like water quality, has been a cornerstone of sound lake management in the United States for the last 20 years. It was first discussed in an article by Wagar in 1966. In this article, Wagar stated that user needs are highly personal and are satisfied by a variety of opportunities. He used the example of camping to illustrate that if a manager provides for the "average" camper, he/she might exclude the desires of the majority. Just as we have seen diversity in the type of campground units that have been developed over the years, from primitive tent sites to full-hookup units, lake management may present similar opportunities for satisfying visitors.

Wagar (1966) suggested that planning should be done with reference toward describing opportunities in the region before deciding how and where the resource can accommodate diverse visitor needs. This approach emphasizes inventory procedures common to the fields of wildlife, fisheries, and forestry. Followed by this understanding of where we are, concerns of where we want to be (objective-setting phase) can be implemented through conflict resolution techniques. These are often categorized as "heavy-handed" (direct) to include zoning, use level restrictions, and area closures or "light-handed" (indirect) to include signing, interpretation, and information brochures that are effective in directing use patterns to achieve recreation quality.

During the early 1970s, carrying capacity studies focused on boat density as the central predictor of crowding. Later, researchers questioned whether evaluating the numbers of boats alone was necessary in declaring an area as "too crowded." Emphasis shifted toward characterizing the set of conditions needed to maintain high-quality experiences. Type of use and behavior, among other factors, emerged as significant contributors to the feeling of being crowded.

In a report to the President's Commission on Americans Outdoors, Stankey and Manning (1988) recommended that managers

- Visualize each recreation area as part of a system of areas.

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* Personal Communication, 1988, Joseph S. J. Tanner, Resource Manager, Falls Lake Project, North Carolina.

- Prepare specific management objectives for all areas.
- Monitor to ensure that objectives are met.

Defining recreation quality depends on providing a range of choices and maintaining recreation setting conditions. The Visitor Impact Management strategy adopted here* focuses on indicators measured through visitor surveys that identify "where we are" type problems. For example, fishermen may complain that they feel crowded in the finger channels of the lake on weekends. Management can decide whether this setting condition is acceptable based on research or the actual complaints of visitors. If it is unacceptable, implying that quality is reduced, alternatives can be examined to maintain a setting condition and ensure recreation quality, e.g., opportunities for a quality fishing experience in specified lake channels on weekends. Obviously, there must be a consideration of alternatives that are managerially feasible prior to writing specific objectives. However, if a condition is judged unacceptable, some management action may be deemed necessary to improve recreation quality.

Research and measurement of visitor perceptions can be used to help managers write objectives for lake management. Although conditions will change over time, quantifiable objectives for visitor experiences, based on problem indicators, can provide a checkpoint reading on how the lake is being managed to meet diverse needs.

Although crowding indicators can provide managers with a "red flag" to identify that a problem exists, crowding alone is an improper criterion for examining objectives and selecting management techniques to improve or maintain recreation quality. Recalling the Wagar (1966) argument that optimum use depends on providing a range of choice, it follows that direct and indirect management actions will depend on determining the types of experiences that a lake can provide. For some settings this approach can justifiably allow for increases in use levels. In other cases, where too many boardsailers and jet skis in the same location pose crowding and safety problems, use levels may indeed be lowered based on objectives for the experiences to be obtained from that setting. Comparison with opportunities in the region can assist this process of determining the types of opportunities and where they can best be provided among lakes, and within each lake unit. A final consideration is the importance placed on reaching offsite users. General population surveys are a means to contact infrequent users along with users who might have been displaced from the recreation lake system.

RECENT STUDIES IN THE RECREATIONAL USE OF CORPS LAKES

Findings from various lakes across the country (e.g., Berlin, Youghiogheny, Raystown, Havasu, Falls, and Jordan) have revealed several general findings important to the direction of future studies, as summarized below.

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* Alan R. Graefe et al. 1988. "A Boating Capacity Evaluation of Raystown Lake," prepared for US Army Engineer Waterways Experiment Station, Vicksburg, MS.

- Although satisfaction has often been regarded as the "bottom line" in recreation management, it has not been easy to measure. Respondents have rated their trip as being very good to excellent while these same individuals may exhibit displacement behavior as they go to different places on the lake or other lakes, and visit at different times of the day, week, and year.

- As a setting or location becomes "too crowded," certain activities are constrained or eliminated during periods of high use.

- Crowding has greater influence on activities that cannot escape the presence of others, such as fishing and boardsailing. Therefore, as use increases, the perception of crowding will likely increase although differentially for certain types of experiences, time periods, and locations.

Although it has been suggested that a single number of boats or a concentration factor such as 7.5 acres/boat be applied to a lake, it should be evident from an earlier discussion that a "capacity number" may provide only a starting point for determining optimal use. Given the dynamics of boating mobility, any lake capacity figure will ignore boating concentrations where actual safety and satisfaction problems may occur. However, spatial data can pinpoint where people are going on the lake and for what activities. This can be used to fulfill two information needs. First, it can portray problem areas where concentrations are particularly high. Second, it can depict activity type settings where people currently go water skiing, fishing, and pleasure boating, among other activities. This provides a basis for preparing management objectives to maintain areas of the lake for certain experiences.

Ideally, people can use outdoor recreation facilities 365 days a year. In reality, use tends to be concentrated during summers and on weekends. Crowding studies should incorporate questions on daily, weekly, and seasonal use patterns to better understand how people are making adjustments to use levels and what adjustments they would be willing to make. Similar to a spatial understanding, this provides a basis for prescribing management actions acceptable to people.

CONCLUSIONS

In spite of considerable progress on management strategies to address recreation quality, it could be argued that a lake recreation system is self-adjusting and the problem will take care of itself. This is not evident in the number of recent technical requests to "solve" the problem of too many users in our nation's lakes. Furthermore, waiting until the problem gets much worse may prevent the implementation of some innovative management strategies. Habits of visitors are often difficult to reverse. Jet skiing, mountain biking, and snowmobiling are examples of activities that have presented potential management problems compounded by increased use.

In characterizing significant trends related to the quality of recreation experiences nationwide, Mr. Roy Feuchter (1980), then Director of Recreation Management, USDA Forest Service, remarked

In the past, we simply provided more opportunities and the quality of the experience went up because our users were either experienced or had backgrounds that allowed them to participate easily and fully. In the future as we continue to urbanize, we will probably have to teach people what is available, where it is, how to reach it, and how to participate--in addition to providing quality opportunities. And providing the opportunities will also be more difficult since there will be more people, more conflicts, more impacts, and probably relatively less resources to work with.

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Wildlife and Habitat Management for Urban Water Resources Projects

by

Chester O. Martin* and Wilma A. Mitchell*

INTRODUCTION

Civil Works projects throughout the United States are increasingly becoming part of the urban and suburban landscape. This is particularly the case with local flood protection projects and dry reservoirs located near metropolitan centers. Additionally, many of the older traditional reservoirs, originally surrounded by rural and forested lands, are becoming engulfed by urban sprawl. This situation is especially critical with regard to "Eisenhower projects" where there is only a narrow fringe of Federally owned land surrounding the lake (Figure 1). A series of small lakes constructed primarily for flood control and recreation in the vicinity of Omaha and Lincoln, Nebraska, represent a specialized urban setting for Civil Works projects (Figure 2). Innovative techniques and modified wildlife management strategies are needed to deal with changes in land use patterns associated with many Corps projects.

Figure 1. Suburban encroachment has become a serious management problem at Corps lakes located near metropolitan centers. Old Hickory Lake, east of Nashville, Tennessee, is shown as an example

* US Army Engineer Waterways Experiment Station, Vicksburg, MS.

Figure 2. The Salt Creek Papio Field Office, USAE District, Omaha, has responsibilities for 14 lakes near the metropolitan areas of Lincoln and Omaha, Nebraska

OBJECTIVES

[illegible] proposed as part of the US Army Corps of Engineers Natural Resources [illegible] to develop and demonstrate management strategies appropriate for [illegible] located in the vicinity of urbanized settings. Emphasis will be placed [illegible] procedures for implementing low-cost management practices compatible [illegible] and recreational activities generally associated with urban environments. [illegible] technology should be of high use to resource managers tasked with [illegible] operational management plans for projects surrounded by human habitation [illegible] increasing nonconsumptive recreational demands.

CHARACTERIZATION OF URBAN HABITATS

[illegible] environment resulting from urban development and increased human activity [illegible] differences substantially modified from its original condition. Structural [illegible] in particular, bring about changes to local climates and soils, which in [illegible] natural vegetation. Traditional landscape practices in urbanized settings [illegible] major modifications to vegetation structure and species composition and [illegible] patterns of succession. The wildlife community is ultimately affected. [illegible] developed landscape may support a species assemblage vastly different from [illegible] that inhabited the site.

Urban Climates

[illegible] climate of an urban site may be distinctly different from that of the [illegible] Factors characteristic of densely populated areas relate primarily [illegible] surface structures or features and to the concentration of [illegible] atmosphere, which affect solar radiation, heat conductivity, [illegible] (Oke, Lumley et al. 1971, Hobert et al. 1980). Changes in air

temperature, humidity, and wind speed can usually be correlated to construction density, degree of surface sealing, and the amount and distribution of green space (Hobert et al. 1980).

Urban soils

Soil conditions are particularly important in urban land management because existing soils are usually limited in terms of quality and quantity. Construction activities typically result in mixing topsoil with subsoil, removal of topsoil completely, or introduction of a large amount of debris into much of the stratum. Additionally, minerals necessary for plant development are often limited or absent, and the soils may suffer from poor drainage, high compaction, and excessive heating. Common problems of urban soils (Hobert et al. 1980, Robinson and Bolen 1984) are

- Lowered water table due to ground water use.
- Poor aeration and decreased permeability.
- Poor drainage.
- Mixing or covering of soils with foreign material.
- Removal of topsoil.
- Compaction caused by vehicular traffic and overuse.
- Increased alkalinity due to nutrient enrichment along roadways.
- Degradation caused by lead pollution and the use of deicing salts.
- Production of gases by decomposing materials on or near refuse dumps.

Urban vegetation

Urban areas typically consist of simplified plant communities, resulting in low species diversity and biological instability (Schmid 1974). These landscapes may consist of only a few species that are often widely spaced and of little functional value. Urban landscapes may also be so manicured and extensively modified by plantings of exotic species that they no longer bear any resemblance to the vegetative community that originally occupied the site. This situation results in biologically sterile systems that provide little habitat for native organisms. Some conditions that are common to typical urban landscapes are

- Predominance of monocultures (e.g., extensive lawns).
- Excessive planting of ornamentals/exotic species.

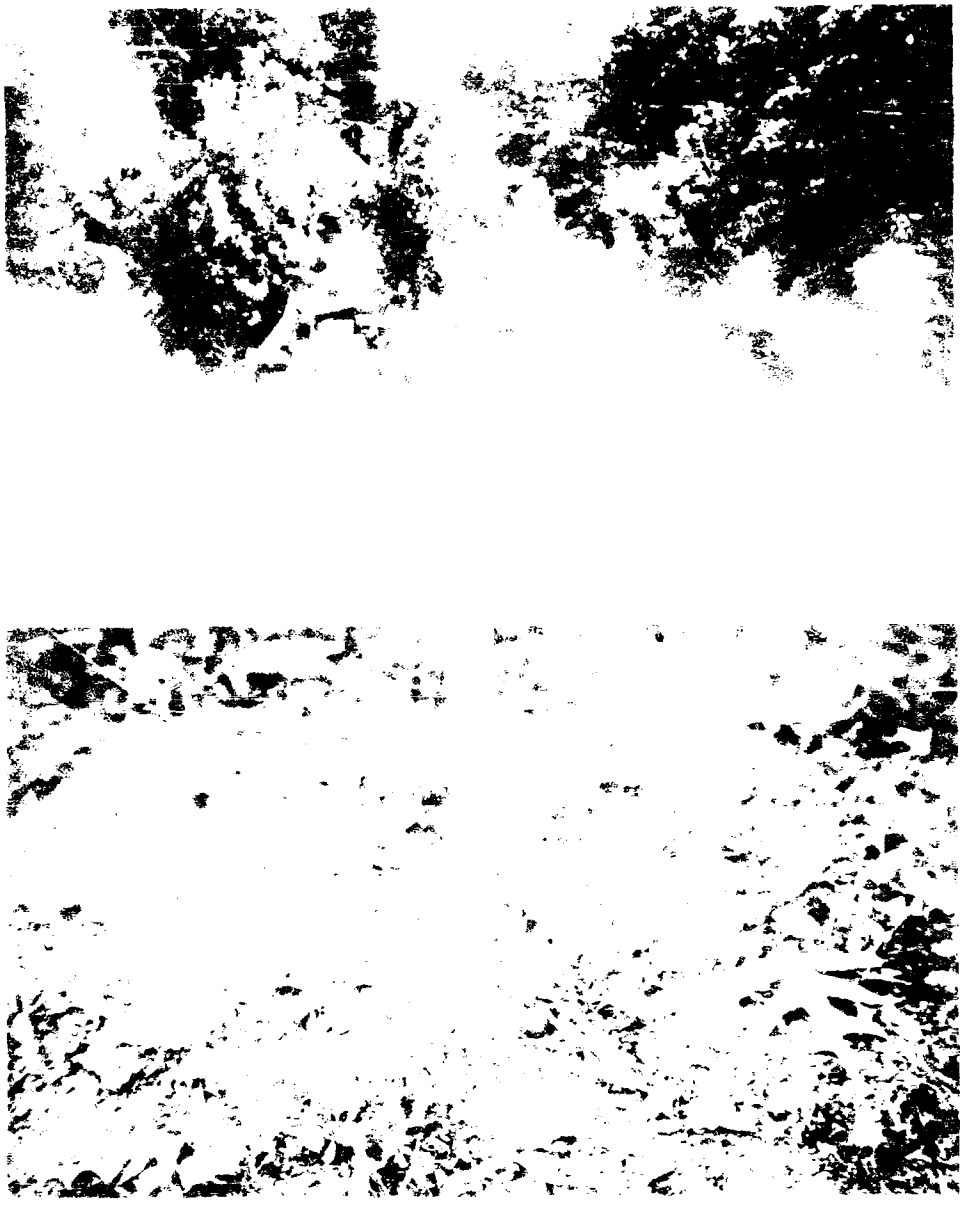

Figure 8. Vegetation management problems typical of urban landscapes include high maintenance requirements (top) and frequent machine damage to shrubs and trees (bottom).

- High maintenance requirements--mowing, watering, fertilization (Figure 3).
- Excessive pruning and shearing.
- High incidence of machine damage to trees and shrubs (Figure 3).
- Planting of species not adapted to local conditions.
- Planting of introduced species that can outcompete native plants.

Urban wildlife

The urban environment presents specialized settings conducive to managing for selected species that are able to live in proximity to man and his activities. However, many urban habitats, especially those along the rural-urban interface, can support a higher diversity of species with proper management and modified landscape practices. Factors that most limit the influx and establishment of wildlife populations in urbanized environments include (Leedy, Maestro, and Franklin 1978; VanDruff 1979; Leedy and Adams 1984; Robinson and Bolen 1984):

- Lack of sufficient vegetation (in terms of both quality and quantity).
- Monocultures created by traditional landscaping practices.
- Habitat patchiness and spatial limitations for some species.
- Structural developments and land uses.
- Intensity of human activity, including types of recreation.
- Presence of domestic animals (especially free-roaming cats and dogs).

PLAN OF STUDY

The proposed work unit will be designed to develop habitat management strategies suitable for application at Civil Works projects in the vicinity of urbanized settings. Major work phases will include (a) background survey of urban wildlife and habitat management, (b) assessment of practices with potential for application at Corps projects, (c) regional survey of management needs for those projects most affected by urbanized conditions, and (d) development of an instructional report on urban wildlife and habitat management tailored to Corps situations.

Topics of investigation for the study will include the following major elements:

- Identification and assessment of potential vegetation management practices appropriate for urban settings.
- Development of appropriate landscape designs with high biological appeal for project recreational and maintenance areas.

- Development of methods for improving habitat diversity in recreational and other high-use areas.
- Assessment of techniques for managing nongame species characteristic of urban settings.
- Control of nuisance animals (wild and domestic) in urban environments.
- Development of appropriate actions to encourage community involvement in urban habitat management programs.

Vegetation/landscape management

Corps projects located in urban settings often serve locally as the largest remaining tracts of green space that can support native plant and animal communities. However, the natural vegetation tends to become increasingly modified over time due to changes in adjacent land uses and increased recreational pressure on project sites. The quality of project lands is also impacted by increased noise levels, erosion from off-project sources, encroachment and vandalism, and invasion of exotic forms of vegetation.

A major effort of the proposed study would be to develop a vegetation/landscape management plan that would maintain the quality of native plant communities subject to the influences of urbanized surroundings. Emphasis will be placed on "naturalistic" landscaping, which incorporates the dynamics of natural plant communities but permits manipulation of the site and vegetative components to achieve human objectives (DuPont 1978). Guidelines will be provided for using native species, especially woody trees and shrubs, for erosion control, amelioration of temperature extremes, noise abatement, air filtration, provision of wildlife habitat, and improvement of aesthetics. The development of vegetated corridors to extend existing habitat and provide an optimum distribution of habitat components will be described. Vegetated buffer strips are especially important along streams and other watercourses, which are often degraded in urban environments (Figure 4).

Specifications will also be provided for establishing new plantings of selected species where the existing landscape has become degraded and provides little functional habitat. Emphasis will be placed on establishing biologically appealing landscapes that require little maintenance. Recommended plantings, designs, and cultivation techniques will be displayed regionally. Appropriate information will be summarized from several recent studies that deal specifically with the use of native plant materials and designs for urban landscapes (e.g., DuPont 1978, Workman 1980, Diekelmann and Schuster 1982, Penn 1982, Smyser 1982).

Wildlife considerations

Urban wildlife management, as in any wildlife management program, consists largely of providing the basic habitat components (food, cover, water, spatial requirements) needed for wildlife to survive and reproduce (Leedy, Maestro, and Franklin 1978; Leedy and Adams 1984). Habitat management in urban landscapes primarily

involves establishing and maintaining the correct types and amounts of vegetation to support a greater diversity of species rather than attempting to optimize management for target game animals. However, some game species can also benefit from the proper management of urban landscapes, especially where larger tracts of green space are available.

Figure 4. Urban streams are often degraded and in critical need of protection and management

Although the emphasis of improving urban wildlife habitat will be on vegetation management, the use of artificial structures to increase site diversity will also be addressed. Features that have potential for urban water resources projects include nest boxes, feeders and attractors, artificial cover, and fence designs. A variety of structural techniques have been described in the US Army Corps of Engineers Wildlife Resources Management Manual (e.g., Marcy and Martin 1986, Martin and Steele 1986, Mitchell 1988); information presented in these reports will be examined with respect to their application in urbanized settings.

Management procedures for urban areas must also consider the control of nuisance animals. Therefore, project managers must be aware of potential hazards and diseases and should have a plan of action to deal with these problems. Free-roaming cats and dogs can be a serious threat to urban wildlife management programs. Strategies for dealing with nuisance animals (both wild and domestic) will be thoroughly described.

Community involvement

An important aspect of urban wildlife and habitat management should be a community awareness and involvement program. A variety of interpretive techniques can be used to explain the importance of habitat management, including slide presentations to area landowners and civic groups, newspaper articles, and local radio/television announcements. Educational materials should be made available to the public and

persons to contact for information and assistance should be designated. Corps projects should consider the use of volunteers to assist with urban wildlife and habitat management efforts. Projects adjacent to metropolitan areas can often benefit from the availability of a variety of service organizations, clubs, and school groups that are eager to do volunteer work. Minor (1989) described the benefits of using volunteers to accomplish a variety of natural resource activities for the Salt Creek/Papio Field Office of the Omaha District.

DISCUSSION

Many Corps projects are becoming increasingly impacted by urban sprawl and the construction of homesites adjacent to project lands. This is a particular concern with Eisenhower projects, dry reservoirs, and small lakes constructed primarily for local flood control and recreation. In many cases, traditional wildlife and habitat management practices may not be compatible with changes in land use patterns brought about by urbanization of the surrounding terrain. Thus, a study is proposed to assess habitat conditions at urban water resources projects and to develop appropriate management strategies for these modified settings.

Major facets of the study will include a background survey of urban wildlife and habitat management techniques, assessment of potential strategies for implementation at Corps projects, investigation of project needs, and development of an instructional report that provides guidelines for applying modified habitat management techniques in urban settings. Emphasis will be placed on developing appropriate vegetation and landscape management practices that will maintain the quality of native plant communities, provide a buffer to protect project lands from the adverse impacts of adjacent urban areas, and result in suitable wildlife habitat for a diversity of nongame species. Techniques for dealing with wild and domestic nuisance animals will be described. Procedures will be developed for implementing a community awareness and involvement program to assist with urban wildlife and habitat management activities.

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Techniques for Restoring Sport and Commercial Fish Habitat in Aging Corps of Engineers Reservoirs

by

K. Jack Killgore* and Edwin A. Theriot*

INTRODUCTION

Habitat quality often deteriorates in aging reservoirs and limits the productivity of the fishery resource. A variety of habitat restoration and enhancement techniques are widely used in Corps reservoirs to improve the aquatic resource base and provide additional fishing opportunities. However, few studies have addressed the biological consequences of these projects on important sport and commercial fish and the benefits to fishermen. As a result, quantitative criteria to select the most appropriate techniques are not well known.

The objective of this proposed study is to identify methods used to physically restore and enhance reservoir habitat and monitor the effects of selected techniques on the distribution and abundance of sport and commercial fishes.

APPROACH

The effectiveness of widely used restoration and enhancement techniques will be evaluated using literature and field studies. Preliminary examination of the literature indicates that placement of artificial structures in water bodies is the most common technique used. Other techniques include vegetation management (riparian and aquatic), placement of gravel for spawning and rearing habitat, bank stabilization using different types of revetment, sediment removal by dredging, artificial aeration, water-level manipulation, and chemical enhancement techniques such as fertilization.

The response of fish populations to enhancement and restoration projects needs to be evaluated. Potential changes in abundance, distribution, and exploitation of sport and commercial fish populations should be considered when developing management strategies. Therefore, field studies will be developed to assess the biological benefits of enhancing and restoring fishery habitat. The limiting attributes of the water body (e.g., lack of food, spawning habitat, or cover) will be considered so that appropriate techniques are selected. The results will provide guidance in the planning, construction, and valuation of various techniques in order to increase the recreational and commercial opportunities of the fishery resource.

* US Army Engineer Waterways Experiment Station, Vicksburg, MS.

Management of Waterfowl Habitats at Corps of Engineers Projects

by

Chester O. Martin*

INTRODUCTION

Many US Army Corps of Engineers projects provide important waterfowl habitat along the major North American flyways, and most Corps Districts include waterfowl management as part of the natural resources program for their project lands (Figure 1). However, waterfowl management objectives and practices are highly variable from District to District, and often there is little consistency among projects within a flyway system. Thus, there is a need to examine existing practices and develop technical guidelines for implementing a comprehensive waterfowl habitat management program for Corps lands. This is especially important in light of current international concern regarding waterfowl habitat losses that led to the development of the "North American Waterfowl Management Plan" (US Fish and Wildlife Service 1986) and a recent Cooperative Agreement between the Corps of Engineers and the USFWS to support the goals of the "Plan" (Department of the Interior/Department of the Army (DI/DA) 1989).

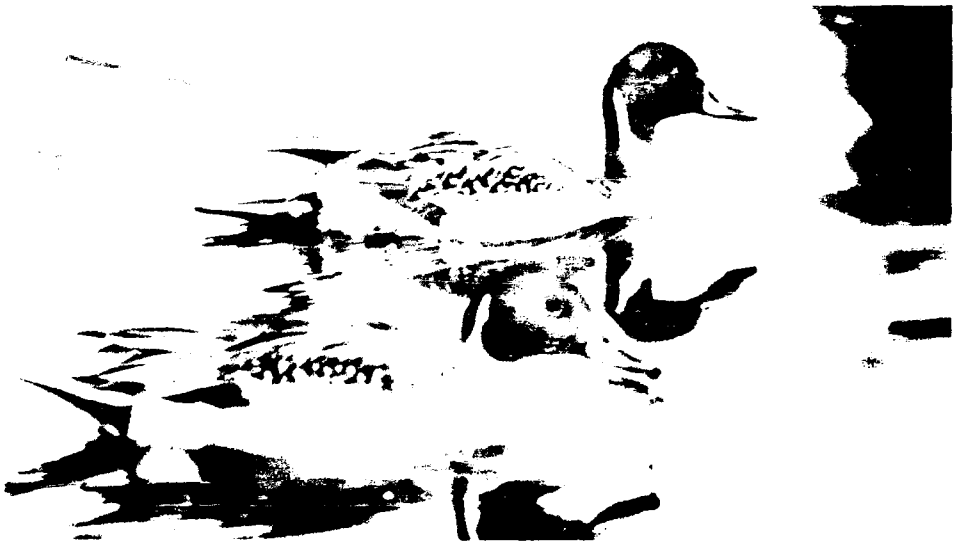

Figure 1. Waterfowl management is an important part of the Natural Resources Management Program at most Corps reservoir projects (photo of pintails (Anas acuta) courtesy of R. J. Martin, Pipestem Lake, North Dakota)

* US Army Engineer Waterways Experiment Station, Vicksburg, MS.

OBJECTIVES

A study of waterfowl habitat management is proposed as part of the US Army Corps of Engineers Natural Resources Research Program. The main objectives of this work will be to examine waterfowl management practices within the Corps and to develop a comprehensive program that can be applied on a regional and national scale. Existing practices will be evaluated, and opportunities for the application of innovative management techniques will be explored. Corps projects that provide, or potentially provide, important habitat for breeding, wintering, and migrating waterfowl will be identified and evaluated. National and regional management strategies will be developed within the framework of the Corps mission. Emphasis will be placed on cost-effective and ecologically sound strategies that can be accomplished through joint venture programs.

BACKGROUND

North American Waterfowl Management Plan

The Plan is a historic conservation agreement between the US Secretary of the Interior and the Canadian Minister of the Environment designed to provide a blueprint for restoring waterfowl populations on the North American continent through the year 2000. The implementing document was signed by the action agencies in May 1986 (USFWS 1986). The overall goal of the program is to restore, maintain, and manage the diversity and distribution of high-quality habitats that will enable waterfowl to achieve population levels that reflect sound conservation practices throughout the continent.

Mission objectives of the North American Waterfowl Management Plan include (a) establishment of goals for duck, goose, and swan populations; (b) identification of habitat conservation needs in specific regions of the continent; and (c) recommendation of measures for resolving waterfowl problems of international concern. The Plan places emphasis on protection and improvement of waterfowl habitat and identifies 34 major areas of concern consisting of approximately 6 million acres in the United States and Canada. It also focuses on a goal to ensure habitat for 62 million breeding ducks and to produce an annual fall flight in excess of 100 million birds. The 1988 fall flight of ducks was estimated at 66 million, the second lowest on record; this compares with fall flights of 100+ million ducks recorded during the 1970s.

Both the Canadian and US wildlife agencies have recognized that accomplishing Plan goals will require timely and effective cooperation among government agencies and between the public and private sectors. This coordination and cooperation process is identified in the Plan as the "joint venture" approach. It provides a framework for establishing federal-state-private partnerships to implement a combination of wetland habitat protection, restoration, and development actions to benefit breeding, migrating, and wintering waterfowl populations throughout the continent (USFWS 1986, DI/DA 1989).

Corps/USFWS Cooperative Agreement

A Cooperative Agreement was signed in January 1989 by the Department of the Army, Corps of Engineers, and the Department of the Interior, US Fish and Wildlife Service, to participate in a coordinated effort to support the goals of the North American Waterfowl Management Plan. The major purpose, as stated in the agreement (DI/DA 1989), is "to provide a plan of coordination and cooperation between the Department of Interior and Department of Army for the conservation, development, and management of habitat for waterfowl and associated wetland species on Army Civil Works projects, in response to goals set forth in the joint United States and Canadian North American Waterfowl Management Plan." Basic responsibilities of the Corps for meeting Plan objectives are to (a) identify the extent to which Civil Works projects address Plan goals, (b) identify other opportunities at operating projects to address Plan goals, and (c) identify and evaluate opportunities for restoring and developing waterfowl habitats during the planning, design, and construction of new Corps projects. Additional responsibilities and procedures, as outlined in the Cooperative Agreement, are summarized below.

USFWS responsibilities

- Initiate coordination with appropriate Corps offices and provide details on regional and national goals.
- Advise Corps Districts of Federal and non-Federal joint venture proponents.
- Provide consultation for planning and implementation of activities to improve waterfowl habitat on Corps projects.

Corps responsibilities

- Provide a list of Civil Works projects in major habitat areas.
- Provide descriptions of waterfowl-oriented management activities carried out by the Corps
- Provide maps and other materials showing the extent and location of waterfowl habitats.
- Provide information on waterfowl management on lands licensed to State wildlife agencies.
- Identify waterfowl habitat improvement opportunities and describe needed actions.
- Invite the USFWS into early stages of planning for new projects to avoid/minimize impacts.

Joint USFWS/Corps responsibilities

- Determine how technical expertise can be shared in addressing Plan goals.

- Coordinate with States during scheduled reviews of General Plans and related licenses.
- Describe how and to what extent waterfowl opportunities would address Plan goals.
- Consider Plan goals during the planning, engineering and design, and construction of Corps projects.
- Share materials and information with joint venture partners.

Civil Works projects

The majority of Corps projects provide a substantial amount of habitat of existing or potential value for breeding, wintering, and/or migrating waterfowl. In general, preferred feeding and resting areas for dabbling ducks occur in shallow backwater zones in the upper ends of reservoirs, and these sites are often designated as project waterfowl management areas. Wetlands and suitably vegetated upland sites adjacent to reservoir shorelines often provide excellent nesting and brood-rearing habitat for Canada geese (*Branta canadensis*) and some duck species. Waterfowl management practices typical of Corps projects include artificial nesting structures, supplemental food and cover plots (usually agricultural grain crops and millets), beaver pond management, and construction and management of small subimpoundments. The most popular management technique applied to leased lands is the planting of food plots (Comiskey 1982). More specialized practices used at some projects include island creation, development of brood pastures, management of greentree reservoirs.

The wood duck (*Aix sponsa*) is the most common breeding waterfowl species at Corps projects in the East and is often a featured species for management. Wood duck populations are also managed at some projects in the Western and Midwestern States (Crowley 1983, [illegible] 1989). Ideal brood-rearing habitat consists of shallowly flooded areas with an interspersion of flooded trees and shrubs, emergent and floating vegetation, and open areas (McGilvrey 1968, Ridlehuber and Teaford 1986), and these habitat components are usually present at Corps projects. The most commonly employed practice for managing the species is the construction and installation of nest boxes, and virtually every project in the East has an active nest box program (Figure 2).

Several projects have conducted experiments on the success of using different types of wooden, metal, and plastic nest boxes. The Columbus Area Office (Mobile District) and the Mississippi Cooperative Wildlife Unit at Mississippi State University recently collaborated on a study to measure the impact of high temperatures on wood ducks nesting in plastic boxes (Hartley and Hill 1988; Hartley and Hill, in press). Although other projects have collected habitat use and nesting data on wood ducks over several years, this information is seldom published and is not readily available to other projects.

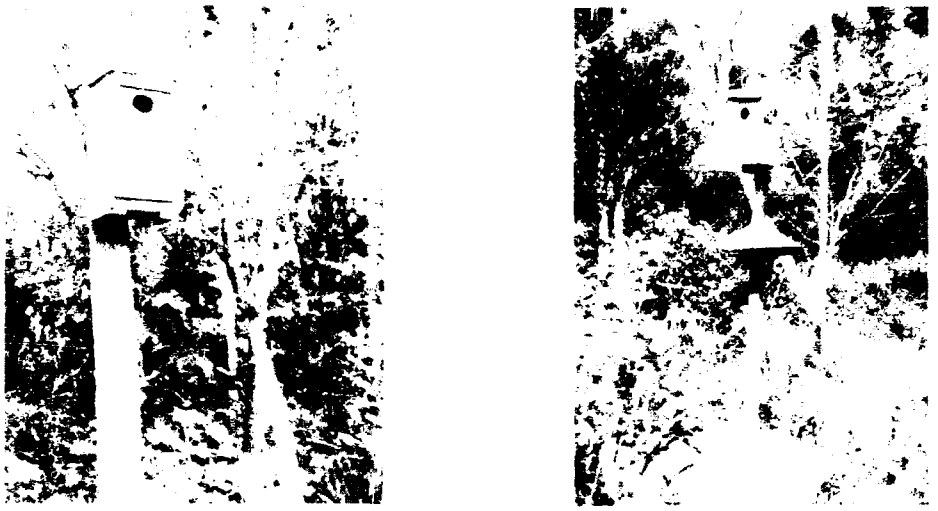

*Figure 2. **Installing wood duck nest boxes is a popular management practice at Corps projects. The inclusion of predator shields (right photo) is highly recommended for next box programs***

Other management practices commonly used in the Eastern States include beaver pond management, establishing supplemental food plots, and water-level management for small subimpoundments. Target species are usually wood ducks and mallards (*Anas platyrhynchus*), and occasionally black ducks (*A. rubripes*). Beaver ponds and seasonally flooded timber in the upper reaches of reservoirs are especially attractive to both breeding and wintering populations of waterfowl at Corps projects (Figure 3). Greentree reservoirs have been constructed and managed successfully at several Corps projects in the Southeast, but extreme care must be taken to ensure proper site selection, construction, and operation for these subimpoundments (Rudolph and Hunter 1964, Mitchell and Newling 1986).

*Figure 3. **Beaver ponds are a common feature at Corps projects in the East. These sites often provide excellent habitat for waterfowl, especially wood ducks***

Corps lakes, especially those in the North Pacific and Missouri River Divisions, have provided important habitats for restoring regional populations of Canada geese, and the species is now featured for management at many projects. Canada goose management programs usually consist of (a) construction and installation of artificial nesting structures (Figure 4), (b) planting of agricultural grain crops to provide a supplemental food source, (c) controlled burning of cool-season grasses near nest sites to encourage the growth of tender vegetation, and (d) development and protection of grass-legume brood pastures (Habermehl 1984; Lenning 1984; Grettenberger 1986; Martin 1988, 1989; Peloquin 1988).

Figure 4. Artificial nesting structures installed at Pipestem Lake, North Dakota, to provide nesting substrate for Canada geese: floating wooden platform (top) and elevated fiberglass tub (bottom) (photos courtesy R. J. Martin

Several Districts have included the creation of artificial islands as part of their waterfowl management programs, primarily to provide protected nest sites for populations of Canada geese (Habermehl 1984, Grettenberger 1986). The Omaha District's Salt Creek, Papio Field Office is presently working with the Nebraska Game and Parks Commission to develop plans for island construction at flood control lakes in the vicinity of Lincoln, Nebraska (Figure 5). The island and wetland complex is designed primarily to improve fisheries habitat but will also benefit nesting geese. A waterfowl management project at Pipestem Lake, North Dakota, included the construction of an "electric-fence island" designed to keep predators out of a prime waterfowl nesting area (Figure 6). The project, completed in the spring of 1988, was a cooperative effort involving the Corps, the USFWS, the North Dakota Game and Fish Department, and several local and regional sporting and conservation organizations.

Figure 5. Canada goose nesting habitat at East Twin Lake, Nebraska. The lake is being drawn down to improve stands of emergent wetland vegetation and to allow the construction of artificial islands

Figure 6. Electric fence island at Pipestem Lake Project, North Dakota--constructed as cooperative effort

Although few District offices appear to maintain long-term records of their waterfowl management programs, the Portland District has conducted an annual Canada goose survey along the Columbia River, Oregon and Washington, since 1981. Nests are surveyed according to District guidelines developed to standardize sampling methods and increase the utility of data collected for management purposes. The District has additionally developed a computer program using dBase III+ to store, compile, and statistically treat the data (Karas 1989).

The above discussion represents only a sample of the variety of waterfowl management programs and activities in existence throughout the Corps of Engineers. Several Districts have a long history of progressive waterfowl management that is consistent with the goals of the North American Waterfowl Management Plan, and joint venture programs are already in effect at several projects (Martin 1989, Minor 1989). However, there is a need to identify new opportunities and improve habitat management for waterfowl and other wetland wildlife. The recent concern regarding the condition of waterfowl on their wintering grounds (Weller 1988) should encourage Corps Districts to develop strategies for improving their projects as wintering and migratory waterfowl habitats.

PLAN OF STUDY

The proposed work unit will be designed to assess the status of waterfowl habitats and management activities within the Corps of Engineers and to develop technical guidelines for operational projects that can be used to support the goals of the North American Waterfowl Management Plan. Major study elements are described below.

- Conduct a survey of existing waterfowl habitats and management practices at Corps projects (to include practices on licensed lands).
- Classify land and water areas according to appropriate habitat type, assimilate habitat information in regional data bases, and code for analysis and display.
- Identify the projects along each major flyway that regionally provide the best habitats for expanded waterfowl management programs.
- Evaluate existing waterfowl management practices, identify problem areas, and assess opportunities for improving current practices and incorporating innovative techniques.
- Develop strategies for improving waterfowl habitat management at Corps projects, with emphasis on joint venture programs.

The study will be initiated with an in-depth survey of waterfowl habitats and management practices at operational projects. Information for the survey will be obtained through questionnaires, examination of project data and maps, and coordination with District and project personnel. Site visits will be conducted at selected projects to obtain additional information as needed. A computerized program will be developed for storing and coding habitat and management data that can be retrieved and displayed according to District, Division, flyway system, or other geographical boundary. This

information will be used to determine the status of existing waterfowl management activities and to identify projects with high potential for more intensive management efforts.

Criteria will be developed to evaluate management practices and assess variability in techniques among Corps projects. Practices will be examined from a regional perspective and in respect to their application at different project types (e.g., flood control, hydropower, navigation). The recent waterfowl literature will be examined, and opportunities will be explored for incorporating innovative techniques, e.g., moist soil management (Fredrickson and Taylor 1982), into existing programs and activities.

Work unit tasks will be extensively coordinated among Corps personnel and waterfowl specialists from other agencies and organizations, and regional workshops will be held to discuss strategies and transfer technology. The final product will be a report that provides technical guidelines for accomplishing joint venture waterfowl habitat management compatible with Civil Works mission objectives.

DISCUSSION

Civil Works projects throughout the United States provide suitable habitat for a variety of waterfowl management activities. Although most reservoir projects address waterfowl as part of their natural resources management program, objectives and practices are highly variable and may not be well coordinated among projects and Districts within major flyways. A need is thus identified to examine existing waterfowl management efforts at Corps projects and to develop a broad-based plan of action that is consistent with the intent of the North American Waterfowl Management Plan

Traditional management practices at Corps lakes include installing nesting structures, planting food plots, and managing beaver ponds and artificial subimpoundments. Several projects have created artificial nesting islands and goose brood pastures, and greentree reservoirs have been constructed at some projects in the Southeast. When properly applied, these practices are generally considered to benefit waterfowl populations. However, many of the traditional techniques have recently been challenged in the literature, and there is a need to reassess their effectiveness at Corps projects. There is also a need to examine the potential for applying innovative techniques, especially those involving the use of environmental engineering designs.

Although the recent Cooperative Agreement between the Corps and the USFWS provides general guidelines for supporting the North American Waterfowl Management Plan, additional guidance is needed from both a technical and procedural perspective. An adequate system for transferring technology on waterfowl management is not available within the Corps at this time. The need for information transfer is indicated by the number of requests for technical assistance on waterfowl submitted by Districts through the Corps' Natural Resources Technical Support (NRTS) Program. NRTS requests on waterfowl management received by the Waterways Experiment Station in 1988/89 are as follows:

- Request for literature search on the design and operation of small waterfowl subimpoundments (John H. Kerr Reservoir, VA, USAE District, Wilmington).
- Request for field inspection and assistance with guide specifications for small waterfowl subimpoundments (John H. Kerr Reservoir, VA).
- Request for assistance concerning the construction and management of islands for nesting waterfowl (Salt Creek/Papio Field Office, NE, USAE District, Omaha).
- Request for onsite inspection and management recommendations for greentree subimpoundments and waterfowl food plots at Falls and Jordan Lakes (Falls Lake Project, NC, USAE District, Wilmington).
- Request for site visit and development of design specifications for waterfowl nesting islands at East Twin Lake, Nebraska (Salt Creek/ Papio Field Office, NE, USAE District, Omaha).
- Request for assistance to assess declining waterfowl use at the Askew Management Area (Arkabutla Lake, MS, USAE District, Vicksburg).

A particular concern in respect to technology transfer is the paucity of published information on wildlife management activities at Corps projects. Although the results of several waterfowl projects have been printed in the Corps newsletter Wildlife Resource Notes, there appear to be few studies published elsewhere. Thus, information exchange is largely incidental among Corps biologists and resource managers, and the conservation community at large tends to have little knowledge of Corps efforts to manage waterfowl resources.

The Corps/USFWS Cooperative Agreement on waterfowl management should be viewed as a landmark step for improving the stewardship of natural resources on Corps projects. It will be incumbent on Division and District offices to examine their existing programs and develop creative strategies to ensure the conservation and management of waterfowl resources on project lands. The intent of the work unit proposed herein is to provide technical assistance, where needed, to facilitate accomplishing the objectives of the North American Waterfowl Management Plan and the Cooperative Agreement.

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Multiple Species Management on Corps of Engineers Project Lands

by

Thomas H. Roberts* and Chester O. Martin*

INTRODUCTION

Wildlife management practices on Corps of Engineers project lands are usually oriented toward larger game species such as white-tailed deer (*Odocoileus virginianus*) and wild turkey (*Meleagris gallopavo*), whereas small game and nongame species often receive nominal attention. Development of a comprehensive management plan incorporating features that result in multiple species benefits would enable the project biologist to provide additional hunting or other recreational opportunities as part of the natural resources management program. The multiple species approach would also allow greater management flexibility, increase habitat diversity, and improve the environmental quality of the area.

OBJECTIVES

A study on multiple species management is proposed as part of the US Army Corps of Engineers Natural Resources Research Program. The objective will be to develop and evaluate wildlife management strategies that offer benefits to several species or groups of species simultaneously, while ensuring that benefits to the target animals are maintained (Figure 1). Implementation of procedures that prove successful should result in increased populations of both large and small game animals and increase the overall diversity of wildlife at Corps projects.

PLAN OF STUDY

The proposed work on multiple species management will consist of the following phases: (a) background survey of potential management strategies, (b) comparison of methods for further study, (c) field application of selected strategies, (d) evaluation of the success of multispecies management at project field sites, and (e) development of a technical report on multiple-species management strategies, to include guidelines for their application at Corps projects. Examples of practices to be considered for examination and implementation at project sites are discussed below.

* US Army Engineer Waterways Experiment Station, Vicksburg, MS.

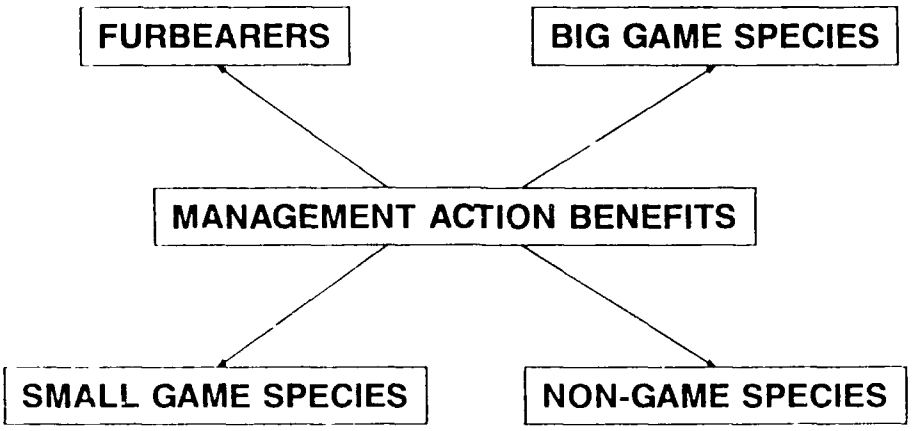

Figure 1. Development of strategies for multiple species management would result in benefits for a variety of game and nongame animals

No-till agriculture

No-till agriculture has considerable potential to increase populations of a variety of ground-nesting birds and small mammals in many areas (Rodgers and Wooley 1983, Warburton and Klimstra 1984, Dimmick and Minser 1987). Figure 2 shows an example of no-till agriculture, where wheat stubble was left in a field after spring harvest at a site in western Tennessee. Under no-till management, the field was not plowed prior to planting soybeans, and the stubble provided excellent nesting cover for bobwhite quail (*Colinus virginianus*) (Dimmick and Minser 1987). Researchers have found this practice to be an excellent way of providing suitable nesting cover for bobwhite and ring-necked pheasant (*Phasianus colchicus*) where that component of their habitat is limiting, which is often the case in intensive agriculture areas.

Controlled burning

Fire can be used as an effective management tool for many game and nongame species, and altering the frequency of burning can improve the value of habitats for a variety of wildlife in addition to the target animal. For example, burning a mature pine (*Pinus* sp.) stand every 3 to 5 years in the Southeast is sufficient for white-tailed deer (e.g., burning at this interval will sustain browse and soft mast production) (US Forest Service 1980). However, stands may become too dense for quail and turkey if not burned every 1 or 2 years. A multiple-species approach would consist of shortening the frequency of burning on portions of these areas to improve habitat conditions for quail and turkey as well as deer. Since hard and soft mast-producing species comprise a major part of both birds' diets, it is desirable to ensure that portions of stands are burned only every 3 to 4 years (McRae et al. 1979). Therefore, by simply manipulating burning schedules, benefits to multiple species can be realized. Food for quail and turkey cannot be produced in dense sapling or small pole stands; thus, these sites should not be burned more often than is recommended for deer management.

Figure 2. Management area on the Ames Plantation in western Tennessee, where wheat stubble was left in the field after spring harvest. No-till practices such as this result in excellent nesting cover for ground-nesting species such as bobwhite quail

Diversified plantings

Traditional wildlife food plots often consist of plantings of one or two commercially available species. However, seeds and seedlings of new or improved varieties are being tested experimentally and may be obtained from commercial, State, or Federal nurseries. For example, a new variety of bicolor (*Lespedeza bicolor*) that could prove beneficial to game birds is "Amquail." The variety produces an abundance of seed and is highly resistant to browsing by deer (Surrency 1988). It has a bushy growth form, which provides the additional benefit of cover to a variety of species.

Seed mixes of native perennials or reseeding annuals can be especially beneficial to small game and nongame species. For example, establishing partridge pea (*Cassia fasciculata*) and beggar's ticks (*Desmodium* spp.) adjacent to woody cover will improve food and cover resources for quail and other seed-eating birds; excellent cover will also be provided for cottontail rabbits (*Sylvilagus* spp.) and other small mammals (Figure 3). This type of habitat will need little maintenance, except for occasional burning or disking, and will become invaded by a variety of other native species, thus resulting in a diverse herbaceous community.

DISCUSSION

The emphasis of the proposed study will be to identify and implement management actions that provide simultaneous benefits to a variety of species, while continuing to improve habitat quality for the species of major interest. Many existing multiple-species strategies have considerable application to Corps lands. Some of these practices have been recently implemented on several projects, but they have not been widely used.

Figure 3. Establishing native perennials and reseeding annuals will result in high-quality habitat for many species of small game and nongame wildlife

study will emphasize the application of cost-effective techniques and selection of low-maintenance vegetation plantings for wildlife habitat development. Other management strategies/options to be examined will include improving site preparation techniques, optimizing spatial arrangement of cover types to produce food and cover, maintaining large woodland tracts for interior forest species, and developing vegetative corridors where habitats have been fragmented. Low-intensity surveys will be used to evaluate the success of strategies tested at selected project sites.

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Applied Research Issues in Cultural Resource Management

by

Frederick L. Briuer*

BACKGROUND

Entering into the last decade of the 20th century, managers of cultural resources on public lands are faced with several challenges brought about by significant shifts in Federal actions, changes in public laws and agency regulations implementing these laws, as well as changes in the interpretation of the legal requirements. As a consequence of these changes, perceptions of research needs for cultural resource management are also changing.

Throughout the seventies and early eighties, a great deal of the cultural resource manager's time, energy, and financial resources was directed toward solving problems directly related to the planning of Federal actions such as construction projects or timber sales, requiring surveys, evaluations, or data recovery mitigation so that the planned actions could continued in a timely fashion, avoiding expensive and controversial schedule delays or litigation problems. Much of this activity resulted in descriptive reports demonstrating little research or management value beyond documenting legal compliance. Changes in Federal actions are resulting in a reevaluation of some conventional cultural resource management practices, objectives, and traditional emphases. This reevaluation is to some extent a direct result of agency mission changes. Such changes in mission are perhaps most dramatic in the US Army Corps of Engineers and the Bureau of Reclamation, where the construction of reservoirs and flood control projects throughout the Nation has been steadily winding down.

The National Historic Preservation Act of 1966 (Public Law (PL) 89-665; 83 Stat. 915) as amended (16 U.S.C. 470 et seq.) and the Archaeological Resources Protection Act of 1979 (PL 96-95; 93 Stat. 721; 16 U.S.C. 470 et seq.) require management programs including long-term stewardship of cultural resources. Characteristically, public laws do not give much detailed guidance on how these goals should be accomplished. The publication of Engineer Regulation 1130-2-438 implements the above public laws and is one example of an agency's shift in management emphasis from a planning to an operations perspective.

The new Corps Engineer Regulation spells out what it will take for all operational projects to comply. In a nutshell, actions regulated to the operation of Corps of Engineers projects that may result in the unnecessary damage or destruction of historic properties are seen as no less a potential violation of public law than planning actions for large-scale, expensive dam and reservoir construction projects. Historic Property

* US Army Engineer Waterways Experiment Station, Vicksburg, MS.

Management Plans addressing specific long-range management strategies are now required of all operational Corps projects.

The reevaluation of management strategies and research needs is also evident in other agencies. The US Forest Service, for example, has been conducting surveys and recording thousands of sites for over 15 years. Although not as dramatic as the winding down of inundation projects mentioned above, a shift in Forest Service policy is affecting cultural resource management practices. The National Forest Management Act 1979 (36 CFR 219) requires that individual forest plans include solicitation of public input during the development of these plans. As a result, there has been some shift from traditionally dominant interest in commercial timber sales to a more balanced set of priorities and diversification of management interests including public recreation, wildlife conservation, and cultural resource management. A recent Forest Service publication (Tainter and Hamre 1988) focused on concerns for developing better cultural resource management tools and research priorities for viewing cultural resource management as a long-range process of stewardship rather than a set of discrete compliance events responding to plans for timber sales. A shift toward a more balanced set of management interests is not exclusive to the Forest Service.

DEVELOPING CULTURAL RESOURCE DATA BASES

The long-term stewardship of cultural resources, including the formulation and implementation of Historic Property Management Plans, will require new management tools and new research directions. There is a critical need to develop automated cultural resource data bases that allow managers to work smarter rather than harder when spread thin by heavy administrative workloads. Easy to learn, easy to use, but underutilized automated software packages are becoming readily available for routine data base development. Geographic Information Systems (GIS), data base managers, cd-rom, and expert systems are a few of the tools becoming increasingly available to managers with access to personal computers or mainframes. Despite some vendor claims, none of these automated tools are capable, in and of themselves, of doing everything a manager needs. Such tools are particularly useful for data base development when integrated with the distinctive capabilities of other increasingly available planning and operations tools such as computer-aided drafting and mapping systems.

Data bases for the efficient management of cultural resource inventories should be developed concurrently with the mandatory survey, evaluation, and mitigation projects. The traditional hard-copy reports and maps for separate piecemeal projects will not result in the information needed to meet future management meets, unless there is a concerted effort on the part of the cultural resource manager to orchestrate information acquisition and automation efforts on a problem-solving basis. The following questions exemplify some research needs for developing automated cultural resource management data bases:

- How can we begin to responsibly manage complex cultural resource inventories if we don't even know what we have to manage or where it is?
- Does our inability to efficiently manage complex cultural resource inventories, relying on inadequate and unreliable information, force us into unnecessarily

expensive, destructive, and controversial data recovery situations at the expense of not considering feasible, cost-effective, and responsible long-range site avoidance and protection options?

- How can an investment in automated archaeological data with precise locational information on complex regional inventories pay a return on investment for realistically and cost-effectively meeting preservation and protection commitments?

- How can automated archaeological inventories facilitate the task of communicating long-term management plans and options to all involved parties?

EVALUATING SITE SIGNIFICANCE

The basic automation tools are available for routinely preparing regional data bases for both locational (spatial) information and relational data in text files on site attributes. With such tools, managers can use the data base to determine the exact location of resources in order to plan other land use actions or to design construction projects that are not necessarily incompatible with long-term cultural resource protection. Since the data are in an automated form, it is a straightforward matter to coordinate even rather complex site avoidance plans with all concerned parties.

The data base can also be used to select statistically representative samples of resources when grappling with determinations of significance. Automated tools are readily available for constructing large multidimensional data bases for regional inventories of sites (Williams, Limp, and Briuer, in press). Information on site variability *with respect to age, function, historic or social context, environmental variability*, and physical condition of sites represents just a few examples of explicit and formal criteria readily amenable to exploratory data analysis or other statistical analyses for selecting representative samples of resources in a replicable and defensible fashion.

Regional archaeological data bases offer a management alternative to traditional site-by-site, project-by-project evaluations of significance based on highly subjective criteria. A holistic approach to the analysis of multidimensional regional archaeological data alleviates the problem of not seeding the forest because of the trees, when evaluating individual sites without considering broad regional patterns (Briuer 1989). A gestalt approach to the evaluation of significance offers additional assurances that it is possible to set aside a more representative sample of resources for answering current as well as future anthropological research questions.

IMPACT EVALUATION

Professional archaeologists employed in cultural resource management studies have not been overwhelmingly interested in research designed to better identify, understand, and predict processes of cultural resource destruction. Little research has been devoted to impact processes threatening cultural resources on planned construction or operational projects. Wildesen (1982) puts conventional management approaches into two categories: exploitation and conservation. The exploitation camp would, for usually

obvious reasons, prefer to mitigate perceived impacts by traditional archaeological data recovery and thereby legally clear the action. The conservation camp has been pressing for avoiding impacts by modifying or relocating potentially adverse actions. Both schools of thought suffer from a dearth of research results on the types, degree, extent, and duration of impacts of archaeological sites.

Some notable exceptions to the failure of archaeologists to recognize impact research needs are listed in a bibliography of archaeological preservation and protection research (Hester, Ford, and Murtaugh 1987). Most research has focused on water impacts, including studies of inundation, shoreline erosion, bank failure, dredging, and ice erosion. A modest amount of research has focused on problems of vandalism and the stabilization and protection of rock art and architectural structures. Far less effort has been devoted to research dealing with timber sales, forest fires, agricultural practices, changing, and other land-clearing activities. Other topics for which research interest has been minimal include the study of impacts from natural agents such as rodents, vegetation deterioration, and cultural impacts including high embankment construction, and the destructive effects of military training. The long-term management of cultural resources will require a realistic recognition of these problems along with a search for innovative management solutions.

ARCHAEOLOGICAL SITE PROTECTION AND PRESERVATION RESEARCH

A small but encouraging body of literature is developing that examines the issue of how and under what conditions archaeological sites can be effectively protected (Carlson and Briuer 1986; Thoren, Fay, and Hester 1987; US Army Corps of Engineers 1988). There is a compelling need for applied research as the informational basis for evaluating specific site-protection activities as well as the specific conditions under which these protection techniques might be recommended for preserving valuable but endangered archaeological sites on Corps land.

The use of signs is a commonly employed site protection technique, despite very little substantive research investigating the effectiveness of the techniques used (Gramann and Vander Stoep 1986; Johnson and Swearingen, undated). How effective are various signing strategies under various conditions? The answer to such questions begs a well-planned longitudinal study under controlled conditions. The results of such research should have broad applications, transcending cultural resource management. Depreciative behavior is also a serious and expensive problem for managers of natural resources and recreation areas.

CHANGE DETECTION AND SITE MONITORING

In-place site protection, to avoid destructive impacts and unnecessarily expensive and destructive data recovery programs, has been demonstrated on a limited basis. The blanket statement that site protection is more expensive in the long run has also been challenged at least once (Carlson and Briuer 1986, p 27). Skepticism about site-protection alternatives is an understandable reaction to the assumption that management responsibilities have been completed because sites were avoided during construction.

This rationale carries with it the danger of a "cheap, quick fix," when in fact the only thing avoided is management responsibility. There is a critical need to disseminate information on the success of various protection strategies. It is no less imperative to fine rigorous, objective, and cost-effective ways to ensure that site protection actually works and continues to work.

The ability to monitor the condition of sites over time and to detect deleterious change on archaeological sites can be enhanced with an investment in automated inventories with precise information on the location, condition, and description of sites in a GIS data base. High-resolution remotely sensed imagery, periodically updated and georeferenced to archaeological site GIS layers, has the potential to become a cost-effective way to periodically monitor archaeological inventories. Remote sensing and GIS tools for automated archaeological inventories represent improvements in site-condition evaluation by removing some of the subjective elements characteristic of labor-intensive onsite ground truth monitoring methods.

Research is needed using mature automated archaeological inventories with baseline site-condition data comparing before and after remote-sensed imagery in order to develop change-detection criteria verified by ground truth observations. Remote-sensed monitoring has the potential for detecting change brought about by such impacts as off-road vehicular traffic or vandalism at protected sites or districts. Remote-sensed monitoring also has the potential for improving law enforcement surveillance capabilities in view of the limited number of law enforcement officers with responsibilities for tremendous numbers of widely distributed sites.

CURATION

There is a growing awareness of the problem of what to do with the tremendous number of artifact and record holdings accumulated after many years of Federally funded projects. The curation of these archaeological holdings has often been tolerated as a warehousing problem for things. It is no longer defensible to assume that the problem can be handled by the existing overcrowded academic and private sector curation facilities. There is an urgent need to establish minimally acceptable Federal standards for the responsible curation of present holdings and future acquisitions. It makes little sense for each Federal agency to "reinvent the wheel" by establishing separate policies or separate curation facilities.

Research is needed to look at professionally acceptable curation alternatives, including automated standards and techniques for more efficient accessioning and recording of existing as well as future holdings. In this way, holdings can be better used for their intended informational value. How can one begin to evaluate the scientific and public appreciation value of archaeological resources as places on the ground, if we were to attempt to do this without considering the informational value of artifacts collected from these locations? Many of the collections at present are difficult to locate, in poor condition, and for all practical purposes cannot serve their intended research use because of exceedingly poor or unsystematic documentation. It would be beneficial to initiate a pilot study to show how standard systems of property accountability, accessioning, and classification could be applied. Regionally sensitive sampling strategies for establishing curation priorities need to be considered. Levels of curation effort should also

be considered so that, for instance, underrepresented, rare perishable items would be curated differently than overrepresented, redundant items in a region, such as burned rock.

SUMMARY AND CONCLUSIONS

Changes in agency missions will continue to result in changes in perceptions of applied research needs for cultural resource management. Engineer Regulation 1130-2-438 requires Historic Property Management Plans for all Corps operational projects. The plans will require a commitment to manage cultural resources as a long-range process of stewardship rather than just a set of discrete project-oriented compliance events. To meet this challenge, there is a need to develop more sophisticated data bases resourcefully employing the latest information systems technology for grappling with some difficult management problems, such as the evaluation of both sites and impact processes, neither of which is a simplistic self-evident exercise. Other research directions discussed concern techniques of site protection and preservation as well as deleterious change detection and efficient site-monitoring strategies. Questions were raised along with some discussion of research possibilities that should assist managers in coping with the growing problems of curation and the increasing destruction of the archaeological record as a result of vandalism.

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