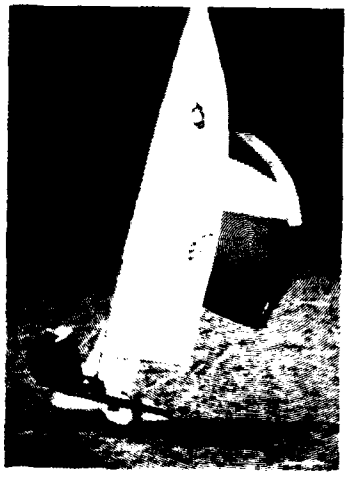
US Army Corps of Engineers



ENVIRONMENTAL LABORATORY

NATURAL RESOURCES RESEARCH PROGRAM

MISCELLANEOUS PAPER R-92-4

PROCEEDINGS, 17TH ANNUAL MEETING, NATURAL RESOURCES RESEARCH PROGRAM

29-30 APRIL 1992 ST. PAUL, MINNESOTA

U.S. ARMY ENGINEER WATERWAYS EXPERIMENT STATION

November 1992

Final Report

Approved For Public Release; Distribution Is Unlimited

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

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The 17th Annual Meeting of the U.S. Army Corps of Engineers Natural Resources Research Program was held in St. Paul, MN, on 29-30 April 1992 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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Contents

Preface

The 17th Annual Meeting of the U.S. Army Corps of Engineers Natural Resources Research Program was conducted in St. Paul, MN, on 29-30 April 1992. The program review, required by the Directorate of Research and Development, was organized by personnel of the Natural Resources Research Program (NRRP), which is managed under the Environmental Resources Research and Assistance Programs (ERRAP) of the Environmental Laboratory (EL), U.S. Army Engineer Waterways Experiment Station (WES), Vicksburg, MS.

Presentations by WES personnel were prepared under the general supervision of Dr. John Harrison, Director, EL. Mr. J. L. Decell was Program Manager, ERRAP. Ms. Judy Rice and Mr. Robert Daniel were Technical Monitors for the Headquarters, U.S. Army Corps of Engineers.

Dr. A. J. Anderson, Assistant Program Manager, ERRAP, for the NRRP, and Ms. Billie Skinner, Program Managers' Office, EL, coordinated the organizational activities of the meeting and efforts leading to publication of the proceedings.

At the time of publication of this report, Director of WES was Dr. Robert W. Whalin. Commander was COL Leonard G. Hassell, EN.

Agenda

Wednesday, 29 April 1992

7:45 a.m.		Welcome - COL Craig, Commander, USAE District, St. Paul
8:00 a.m.		Announcements and General Comments - A. J. Anderson, USAEWES
8:05 a.m.		Comments by the Technical Monitor - Judy Rice, HQUSACE
8:20 a.m.		Comments by the Manager, Environmental Resources Research and Assistance Programs - J. L. Decell, USAEWES
8:40 a.m.		Interagency Panel Edward Dickerhoof, USDA Forest Service Gene Hester, National Park Service Mary G. Henry, U.S. Fish and Wildlife Service Bruce Van Haveren, Bureau of Land Management John Lambert, Bureau of Reclamation
10:10 a.m.		*Break*

Proposed Work Units

10:30 a.m.	375-1	Resolving Wildlife-Human Conflicts at Corps Projects - Chester Martin
10:50 a.m.	375-2	Restoration of Sand/Gravel Mining and Gravel-Impacted Sites - Dick Lee
11:10 a.m.	375-3	Development of a Corps-wide Wildlife and Habitat Resources Inventory Database - Chester Martin
11:30 a.m.	375-4	Evaluating the Use of Ground-Penetrating Radar to Locate Human Burials - Fred Briuer
11:50 a.m.		*Lunch*

Work Units In Progress

1:10 p.m.	32797	Effect of Reservoir Operations on Recreation Fisheries - Phil Kirk
1:30 p.m.	32745	Measuring the Effects of Recreation Fee Programs - Chris White
1:50 p.m.	32744	RDS—Evlauation of Camping Trends at CE Projects - Scott Jackson

2:10 p.m. *Break*

2:30 p.m. Breakout Session—Division/District/Project - David Wahus, Facilitator

4:45 p.m. *Adjourn*

5:30 p.m. *Reception*

Thursday, 30 April 1992

8:00 a.m. Announcements - Dr. A. J. Anderson, USAEWES

Work Units In Progress (Continued)

8:15 a.m. 32574 Regional Recreation Demand Model - Jim Henderson

8:35 a.m. 32728 Management of Water-Based Recreation Opportunities - John Titre

8:55 a.m. Report on Breakout Session - Frank Star, USAE District, St. Paul

9:30 a.m. *Break*

FY93 Civil Works R&D Program Review

10:00 a.m. Announcements - Ed Theriot, R&D, HQUSACE

10:10 a.m. Questions, Answers, and Discussion

11:20 a.m. Preparation and Submission of Input Forms

11:40 a.m. Adjourn FY93 Natural Resources Research Program Review

11:45 p.m. *Lunch*

Field Trip

1:00 p.m. St. Paul District-sponsored field trip and demonstrations

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Introduction

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

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

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

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

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

The contents of this report include the presentations and discussions of the 17th Annual Meeting, held in St. Paul, MN, on 29-30 April 1992.

Comments from Natural Resources Management Branch, HQUSACE

by
Judy Rice[1]

Good morning. It's good to be here today—on time, in the right city. Dave [Wahus] and I made sure we didn't go through Detroit this year on the way. Not only did we not want to miss anything, but we didn't want to put up with all the ribbing we took last year!

I'd like to thank North Central Division and the St. Paul District for hosting us so graciously this year. I'm sure we all appreciate the extra time and effort you've taken to make us feel welcome. I spent the last few days in Ely, Minnesota, about 4 hr north of here. It is a beautiful area, but it was a little chilly. It snowed on me, in fact. Now, at this point I intended to encourage someone with warmer weather and a coastline to host next year's program review. However, John Tyger, under the influence last night, perhaps, of major league baseball, volunteered to host us next year. So, thank you, John. We will meet in Portland next April.

We've had some successes in the NRRP this past year. We finished up the work unit on Economic Impacts of Corps-Managed Recreation Areas and began work on a new unit, Management of Water-Based Recreation Opportunities. We now have plans of study and the study to Measure the Effects of Recreation Fee Programs. We are finishing up this year the work unit on estimating dispersed visitation and can reasonably expect at least one new start for FY93.

We're making progress! And, we're getting noticed! For one thing, thanks in major part to your interest and participation, the R&D committee saw fit to increase our research budget by almost 30 percent for FY92. This is significant. It's the first time in many years we've seen a major increase in funding for this program. And it is a direct result—not only of the way Lewis [Decell] and his staff run the program at WES—but also of the Directorate of Research and Development (DRD) noticing the field's commitment and involvement in this program. The NRRP has a reputation within DRD as a dynamic, energetic program that addresses the needs of the resource manager in the field. All of you share the credit with Lewis and his staff for this reputation, and all of us in the Natural Resources program share the benefit of that reputation.

I think we can all agree that the goal of the NRRP is to provide natural resource research support to the resource manager in the field. We've talked in the past about improving communications between researcher and manager—to ensure that needs are properly expressed, research is properly directed, and products are properly distributed. We've made some significant progress in this regard, I believe, and although improved communications within our group remain vitally important, there are other things we can do to increase research support to the field.

We can continue to improve our reputation as a dynamic, field-oriented program. We need good Field Review Group (FRG) representation at our program reviews, and we need active participation by the FRG members and POCs throughout the year. We need people who have the time and the interest to pursue the program—to review plans of work, to identify and forward new work units, to relay communications between their resource managers and WES and Headquarters, and to promote the program.

We've had a couple of changes in FRG membership this year. Susan Whittington will replace Gerald Purvis as the South Atlantic Division representative, and Ken Waldie will replace Jerry

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

Smith as the Southwestern Division representative. Neither Susan nor Ken is new to the research program. Both have shown a sincere interest, and I'm sure each will do a fine job. Those FRG members and POCs who do not, however, have the time or the interest or the resources to effectively represent their Division should consider giving up their designation and allow someone who can actively participate to do so.

Another way we can increase our effectiveness in providing research support to the field is to capitalize on other research facilities' efforts in natural resources. The other Federal land managing agencies have significant research programs. Some are much larger in terms of dollars than ours is—and produce research products we can use. Similarly, we have high-quality research that may be of interest to them. We in Headquarters began looking more closely this year at the potential for cooperation among the Federal land managing agencies in the research arena.

Some of the possibilities for cooperation include developing a multi-agency inventory of research reports and ongoing work units. That way, if one of our managers, for instance, has a need for some research assistance in a particular area, he or she can consult the inventory and determine if there is work in that area. We are also planning to routinely distribute information newsletters and research reports among agencies. And, we will continue to look for other ways to get more "bang" for the Federal research buck.

You will notice that on the agenda today we have a panel of representatives from other Federal land managing agencies, who will be talking to us about their research programs—the efforts they have ongoing, and what they see for the future. We should take advantage of this opportunity to compare efforts and see where we might help each other, and in what areas we might learn from each other. I hope they will be able to stay with us through as much of the next 2 days as possible and learn what we are doing, too.

We can also improve the effectiveness of our program by doing a better job of long-range planning. We've talked a lot about getting new work units into the system. We've tried to get ideas bubbled up from the field, and we've taken NRTS requests and sorted and distilled them into work units to address these immediate kinds of field needs. That is a good way to find out what's going on right now, but we also need to look toward the future and plan our program to address our anticipated needs.

Dave recently attended a multi-agency workshop, sponsored by the Forest Service in Ontario, on cultural diversity in the general public—that is, our potential visitors. It was suggested that we need to think about how we will accommodate the needs of that changing clientele. That suggestion has resulted in the establishment of an NRRP Task Force, which will be charged with strategic planning for the future of our research program. The task force will forecast future trends in the physical, social, economic, and political environment which might impact on our projects, and then develop focus areas for our future research efforts. We can stretch our limited research resources if we can focus our efforts more directly through this kind of planning. And, if we develop such a strategic plan, based on a credible forecast of future conditions, it could support our requests to the R&D Committee to make our limited research resources less limited.

So, we have selected Susan Whittington, South Atlantic Division, Don Dunwoody, Missouri River Division, Mike Ensch, Fort Worth District, and Jim Shiner, John D. Flannigan Lake, Huntington District, to serve as task force members. WES will chair the group, and I will also participate as a full working member. We expect to have an initial meeting within the next month and a final product by the end of July. You will be hearing from the task force soon regarding your input and participation, but if you have any thoughts or ideas now, I encourage you to talk to any of us this week.

I'm excited about this task force, and in fact, the longer I work with the research program, the more excited about it I get. I continue to be impressed with the work WES does in keeping the program running, and my respect for their competence and abilities continues to grow. I hope all of you feel the same way, and I only wish we each had more time to indulge that excitement. Think about it. When was the last time you

were able to work on a single program for 2 full days? I know when it was for me—it was at last year's program review! I'm very much looking forward to these next 2 days and the chance to work with all of you on this one, very important component of our Natural Resource Management Program.

USDA Forest Service Research in Recreation and Natural Resources Management

by
H. Edward Dickerhoof[1]

Introduction

The U.S. Army Corps of Engineers and the U.S. Department of Agriculture Forest Service Research Division have had almost a continuous cooperative research program on a number of issues for at least the last 10 years. Several of these cooperative research efforts have been with our Southeastern Forest Experiment Station. For example, in the early 1980s we had a joint interest in developing improved information on the economic impacts of recreation and tourism. This interest stimulated a conference with Michigan State University, and very useful proceedings (Propst 1985). This is but one example of what we consider to be a very useful and hopefully continuing cooperative research effort.

The Research Division of the Forest Service, at the direction of the Chief, has recently completed a major planning document, entitled "Strategy for the 90's for USDA Forest Service Research" (Sesco 1991). This document confirms our organization's long-time emphasis on development of new scientific information about natural resources, but also lists as a program goal that we will "Communicate useful technical information directly to customers and the general public in a timely manner." In general, our emphasis is moving more toward including technology transfer as an important element of our research program.

The current Forest Service program is based on the expectation that the following major trends will have a major impact on natural resource use and management:

a. Expanding world population and associated demographic changes.

b. Increasing competition for the many uses of natural resources.

c. Increasing public concern and awareness of the environment and natural resources.

These trends call for increased information and multidisciplinary approaches to solve natural resource management, utilization, and policy development problems. Because of these trends, a major goal of our research program is to take a long-term view when addressing national and international environmental and natural resource problems.

Budget Line Item Organization and Fiscal Year 1992 Appropriations

In FY92, total USDA Forest Service Research appropriations were $180,509,000, with an estimated 2,638 FTEs, of which 714 were classified as scientists. Research currently has five budget line items (Figure 1):

- Resources Analysis Research (18 percent of budget).
- Forest Environment Research (23 percent of budget).
- Forest Protection Research (23 percent of budget).
- Forest Management Research (22 percent of budget).
- Forest Products and Recycling Research (14 percent of budget).

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[1] U.S. Department of Agriculture Forest Service, Forest Inventory, Economics and Recreation Staff, Washington, DC.

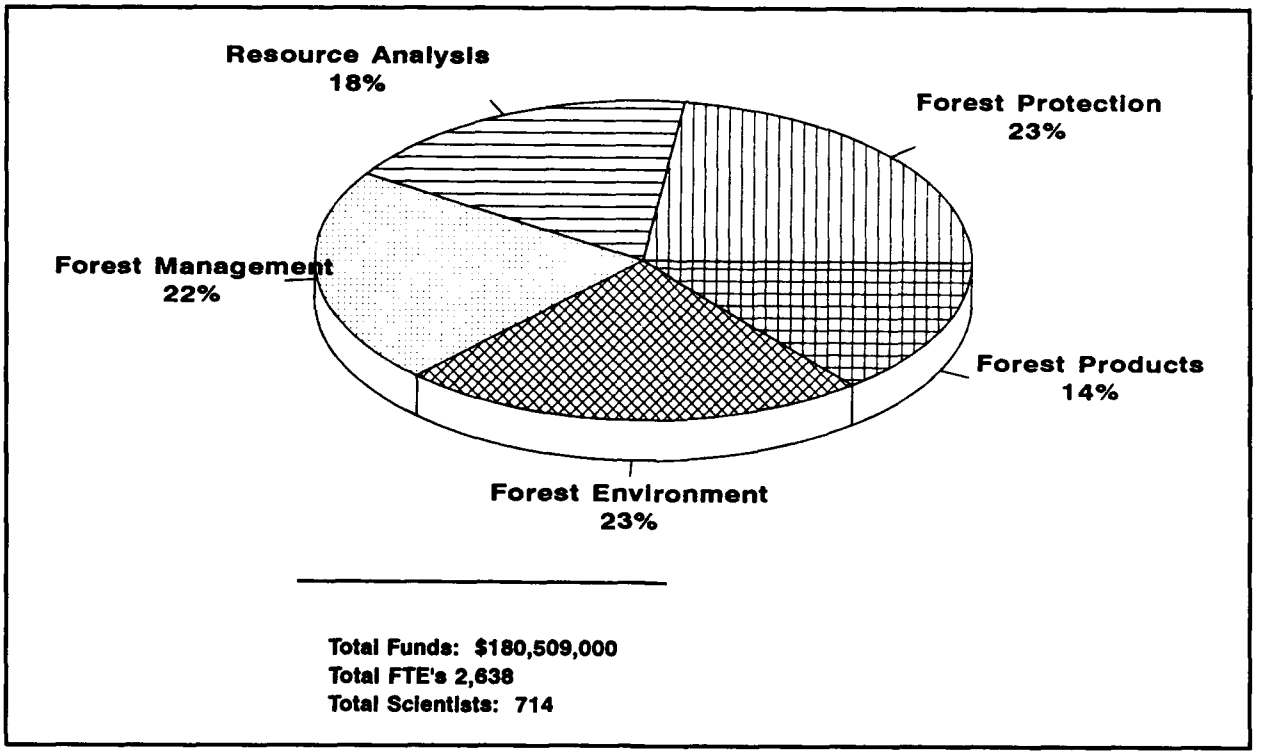

Figure 1. Forest Service research appropriations, FY92

This paper concentrates on the Resources Analysis Research and Forest Environment Research programs.

Until recently, the Forest Service recreation research program was funded in conjunction with our Forest Environment Research (FER) budget line item. Recreation research in the Forest Service is now planned, coordinated, and funded under our Resources Analysis Research (RAR) budget line item. However, because of nature of this meeting, I will also comment on our current and future research program in FER.

Resources Analysis Research and the FY92 Program

Background

In FY92, funding for the RAR budget line item totaled $33,225,000, with FTEs of approximately 499 people. Three major research functions are addressed by our staff: (a) forest inventory and analysis (FIA), (b) economics research, and (c) recreation research (which includes outdoor recreation, urban forestry, and wilderness research). About 85 percent of the total RAR budget is devoted to FIA and economics research (Figure 2). Recreation research funding has not been significant, relative to the support given to other research in RAR or in other research budget line items.

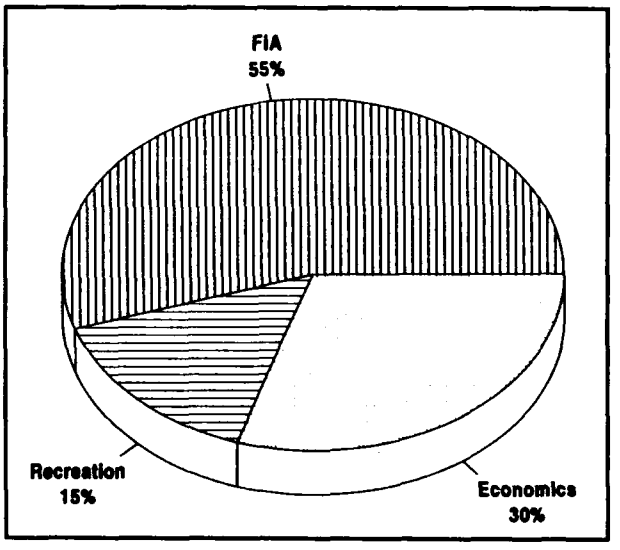

Figure 2. Forest Service, Resources Analysis Research funding, by function, FY92

Much of the work assigned to the RAR Staff is heavily oriented to the development of data and information. This is one reason why the recreation research function was recently transferred to this staff—especially in view of the legislative requirement the Forest Service has through the Resource Planning Act (RPA) legislation. Under this legislative mandate, the Forest Service must periodically update the assessment of national recreation demand and supply trends. The national recreation assessment work is coordinated out of our research work unit headed up by Dr. Ken Cordell, located at the Forestry Sciences Laboratory, Southeastern Forest Experiment Station, Athens, GA. While additional recreation research is also conducted at several other locations, this assessment work is considered to be of high priority. The most recent RPA Assessment update (USDA Forest Service 1989, Cordell et al. 1990) listed the following expected major supply and demand trends for the period 1990 to 2040:

a. Demands for all types of recreation are expected to increase over the next 50 years.

b. Over the last 10 years, about 70 million acres of private lands have been closed to public access for recreation.

c. Most of this decrease in recreation access has been in the East, where relatively little public land is available to offset the decline.

The USDA Forest Service currently has seven outdoor recreation and/or wilderness research project locations:

Outdoor Recreation Projects
- Athens, GA
- Burlington, VT
- Fort Collins, CO
- Riverside, CA
- Seattle, WA

Wilderness Research Projects
- Athens, GA
- Missoula, MT

Recreation research—selected highlights

One of the cooperative research projects the Forest Service currently has in progress with the U.S. Army Corps of Engineers is located on the Tennessee Valley Authority's Guntersville Reservoir in northern Alabama. This reservoir has been selected as a proving ground for a multiagency project aimed at providing guidelines for controlling and managing aquatic plant growth. The Southeastern Forest Experiment Station's Recreation Research Project located at Athens, GA, is the Forest Service unit involved in this cooperative research. Of particular interest is the recreational implication of aquatic vegetation controls.

A second cooperative effort between the Corps and the Forest Service's Athens, GA, research work unit is the National Survey on Recreation and the Environment (NSRE). Part of the NSRE will replicate questions of the previous surveys, enabling scientists to identify recreation trends over a 30-year period. New questions on the survey will establish baseline information for decision-makers about recreation and wilderness use, and public attitudes about our natural resources. With the rapid increase in the cultural diversity of visitors to public recreation sites, the USDA Forest Service has been conducting research to better understand this new visitor population. For example, a cooperative study with California State University, Chico, has recently been completed, entitled "Hispanic Values and Behaviors Related to Outdoor Recreation and the Forest Environment" (Simcox and Phister 1990). The major findings of this study included the following:

a. Mexican/Hispanic users of the recreation areas studied in southern California comprised a culturally complex and diverse group. The group consisted of at least three distinct subgroups, each of which was found to hold unique values for leisure, recreation, and environmental experiences.

b. Overall, the study subjects were most strongly motivated toward low levels of activity, escape, reduction of stress, and enjoyment of family and scenery.

c. Of the depreciative behaviors observed, litter was one of the key behaviors. Users tended to be reluctant to self-police the site. Therefore, the agency may need to intervene to protect the site to increase the quality of experience for the majority of users.

To strengthen recreation management capability, the USDA Forest Service has incorporated evaluation of depreciative behavior in recent studies, as well as suggestions for behavior modification and minimization of maintenance expense (Chavez 1991). The most common and costly problems are trash/litter, graffiti, vandalism, and theft or destruction of signs. Techniques to limit or stop these activities are listed below in priority of effectiveness:

a. High visibility of recreation personnel.

b. Increased law enforcement personnel.

c. Stricter enforcement of rules.

d. Increased visitor involvement.

e. Better communication of the reasons behind the rules.

f. Onsite education or interpretive programs.

g. Incentives for proper behavior.

Recent USDA Forest Service research on litter problems indicates that trash cans need to be placed very near the locations where visitors will need them. After a day of strenuous outdoor activity, parents probably have little energy left to walk back and forth from activity sites to inconveniently located trash cans (Chavez 1991).

Forest Environment Research and the FY 1992 Program

For FY92, total Forest Environment Research funding was $41,655,000, with total FTEs estimated at 599 people. Major program components include the following subject areas:

a. Water and watershed management.

b. Fisheries and fish habitat.

c. Wildlife and wildlife habitat.

d. Rangeland ecology.

e. Wetlands.

Water and watershed management

In the USDA Forest Service Assessment (USDA Forest Service 1989), the following water resource trends are projected for the period 1990 to 2040:

a. Efforts to improve water quality in the future will focus on nonpoint pollution sources, which may be expensive and difficult to regulate.

b. Demand for water withdrawals will increase, leading to possible water shortages in arid and semiarid regions.

Wildlife and fish habitat

Wildlife. Currently, about 300 animal species are listed as threatened and endangered. At least 1,000 species await consideration for listing. Major trends determined by the Forest Service RPA Assessment are that migratory game waterfowl, with the exception of geese, have declined because of drought, intensive agriculture, and loss of habitat.

Fish. On April 16, 1992, the USDA Forest Service issued a memo to all western regional

offices and experiment stations announcing the initiation of the "Pacific Salmon and Steelhead Strategy." The memo also announced a field team and work group to be responsible for drafting specific goals, objectives, and expected outcomes of the strategy.

Fisheries research projects are located throughout the United States at the following locations:

Arcata, CA	Flagstaff, AZ
Berkeley, CA	Franklin, NC
Blacksburg, VA	Juneau, AK
Boise, ID	La Grande, OR
Cordova, AK	St. Paul, MN
Corvallis, OR	Seattle, WA

Wetlands. One of the newest priority research programs in the Research Division is the wetlands research program. The need for emphasis in this area is outlined as follows:

a. Approximately 50 percent of wetlands in the United States were lost over the last 200 years.

b. Wetlands ecosystems are critical for waterfowl habitat, both for breeding and along flyways.

c. Wetland and riparian systems play a major role in flood control and water quality.

The wetlands research program planning process is now nearly complete. Future wetlands research in the Forest Service is expected to emphasize the following:

a. Ecosystem dynamics.

— How do wetlands function?
— How do natural and human disturbances alter these functions?

b. Restoration and rehabilitation.

— What techniques can be used to restore desired functions?

c. Wetland management.

— What are the impacts of current management practices?

d. Are there better alternative practices?

Future program emphasis for Forest Environment Research

The future program emphasis for Forest Environment Research will include:

a. Expanded and accelerated research on threatened, endangered, and sensitive species.

b. Accelerated fisheries and fish habitat research.

c. Reoriented avian habitat research to focus on halting population declines of neotropical migratory birds.

Summary and Conclusions

The USDA Forest Service and the U.S. Army Corps of Engineers have had a very fruitful history of cooperative research. The potential exists for continued and expanded cooperative research, given the increasing pressure for competing uses on limited natural resources. Our mutual needs to determine and track recreation use appear to be of high priority. Also, environmental protection of water and fish resources appears to be of mutual interest and concern. The Forest Service looks forward, as well, to exchange of research results and promotion of technology transfer to the many organizations that depend on our natural resources as well as the public at large.

References

Chavez, Deborah J. 1991. Visitor perceptions of crowding and discrimination at two southern California national forests. Utah State University Shortcourse Paper. (On file: USDA Forest Service, Pacific Southwest Research Station, 4955 Canyon Crest Drive, Riverside, CA.)

Cordell, Ken H., Bergstrom, John C., Hartmann, Lawrence A., and English, Donald B. K. 1990. An analysis of the outdoor recreation

and wilderness situation in the United States: 1989-2040. Gen. Tech. Rpt. RM-189. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO.

Propst, Dennis B., compiler. 1985. Assessing the economic impacts of recreation and tourism. Conference and Workshop, May 14-16, 1984. Michigan State University, Department of Park and Recreation Resources. (Published by Southeastern Forest Experiment Station, Asheville, NC.)

Sesco, Jerry A. 1991. Strategy for the 90's for USDA Forest Service Research. USDA Forest Service, Washington, DC.

Simcox, David E., and Phister, Robert E. 1990. Hispanic values and behaviors related to outdoor recreation and the forest environment; Executive summary. Department of Recreation and Parks Management, California State University, Chico, CA, and Department of Health, Physical Education, and Recreation, California State Polytechnic University, Pomona, CA.

USDA Forest Service. 1989 (Oct). RPA Assessment of the forest and rangeland situation in the United States, 1989. Forest Resource Report No. 26. Washington, DC.

Resolving Wildlife-Human Conflicts at USACE Operational Projects

by
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Introduction

Activities associated with the operation of Civil Works projects (e.g., raising pool levels, construction and management of recreation areas, timber management) often impact wildlife habitats and population levels of a variety of species. In most cases, a certain amount of habitat for a species is simply lost, and the local population is reduced. Additionally, the behavior of some species can be affected, as animals disperse out of previously occupied habitats in search of new range. This is most apparent among wide-ranging species such as deer (*Odocoileus* spp.). Increased movement and concentrations of animals in marginal habitats can result in habitat deterioration, disease outbreaks, malnutrition, wildlife injuries, and higher rates of contact with humans, mainly recreationists and adjacent landowners. Land use activities outside of project boundaries (e.g., housing developments, road construction, timber harvest, grazing, burns, agricultural practices) can also have dramatic effects on wildlife and their habitats on project lands.

Likewise, some wildlife management actions can produce adverse impacts on project operations and recreational activities. For example, introductions of giant Canada geese (*Branta canadensis maxima*) on Corps projects can result in large resident populations that may impact shoreline recreation, foul water supplies, prevent the establishment of erosion control plantings, and increase complaints by neighboring landowners. Also, improperly located habitat improvement projects could serve to attract deer and elk (*Cervus canadensis*) across roads and increase the potential for vehicular accidents.

In most cases, wildlife-human interactions are positive on Corps lands, and the presence of a variety of species provides numerous recreational benefits (e.g., hunting, wildlife viewing) for the public. However, wildlife-human conflicts occur at many projects, and the potential exists for problems to develop that could cause adverse public reaction and negative publicity for the Corps of Engineers. A thorough analysis of the situation and development of management strategies to alleviate or minimize conflicts would allow project managers to deal with these problems proactively rather than retroactively. Early identification and resolution of wildlife problems could also result in considerable cost savings at operational projects.

Background

Wildlife-human conflicts known to occur at Corps projects include wildlife-vehicle collisions; wildlife injuries associated with boundary fences; wildlife damage to agricultural crops and other plantings (both on and off project lands); fouling of recreation areas, water supplies, and lawns by waterfowl (especially Canada geese); damage to vegetation and structures by beavers (*Castor canadensis*) and muskrats (*Ondatra zibethicus*); and wildlife disease outbreaks. These problems and their potential for affecting project operations, recreational activities, and public relations at Corps projects are discussed below.

Wildlife-vehicle collisions

Motor vehicle-deer collisions are serious problems in many parts of the United States, especially where roads bisect habitats in which deer concentrate. This conflict is most apparent in wooded suburban areas where deer and human densities are high, but collisions also

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

commonly occur in rural areas (Hansen 1983, Ishmael and Rongstad 1984, Wood and Wolfe 1988, Porter et al. 1991). Factors that can cause deer to concentrate along roadways include the presence of fawning cover, an abundance of preferred food plants, and flooding, which may temporarily force animals onto higher ground.

Wildlife-vehicle collisions associated with Corps projects are greatest along adjacent off-project roadways where Corps lands border suburban properties and agricultural lands. The construction of new highways along project boundaries can especially increase wildlife-vehicle collisions. A high incidence of road-kills of smaller animals may also occur in these areas. Although the collisions may not occur on project lands, wildlife deaths along roadways can result in a public image problem for the Corps. Boundary fences constructed without regard for wildlife can also result in injury and increased mortality along roadways. This is especially a problem where conventional four-strand barbed-wire fences are installed in areas of high game populations (Figure 1).

Figure 1. Improperly constructed and located fences can impede wildlife movements and often result in death or injury

Damage to crops and other plantings

High populations of deer and elk have been reported to damage agricultural crops, fruit orchards, and nurseries (Anthony and Fisher 1977, Hygnstrom and Craven 1988, Austin and Urness 1989, Conover 1989), which can cause economic losses and result in adverse public reaction from property owners adjacent to Corps lands. Deer and elk populations that exceed carrying capacities can also negatively impact native plant communities and thereby affect the abundance and diversity of other wildlife species. Studies have shown that high deer populations can result in changes to forest canopies, slow the regeneration of important commercial species, and affect the composition of entire plant communities (Alverson, Waller, and Solheim 1988), which may produce conflicts with vegetation management objectives for an area (Porter et al. 1991). Cottontail rabbits (*Sylvilagus* spp.) and various rodents can cause damage to trees and shrubs in shelterbelts and other plantings (Shoten 1988; Barnes, Keyser, and Linder 1989). Waterfowl damage to vegetation is discussed below.

Waterfowl damage

Corps projects throughout the United States provide important aquatic and wetland habitats for waterfowl (Martin 1989), and many reservoirs support large seasonal concentrations of migratory species. Additionally, resident populations of giant Canada geese have been established at a large number of projects in the Midwest and Southeast. Waterfowl management actions at Corps projects provide important contributions in support of the North American Waterfowl Management Plan, and the presence of abundant waterfowl populations generally results in recreational benefits to the public. However, seasonal concentrations of waterfowl and expanding Canada goose populations can cause serious problems on Corps lands and adjacent properties.

Introduced populations of Canada geese and domestic waterfowl have been responsible for substantial environmental and recreational damage to urban lakes, including Corps reservoirs near metropolitan centers (Figure 2). Specific problems include fouling of recreation areas and water supplies, harassment of campers, and damage to shoreline vegetation, lawns, and golf courses (Conover and Chasko 1988, Conover 1989). Waterfowl concentrations in recreation areas and small impoundments may pose a health risk to the public because of the accumulation of excrement and associated diseases. Uncontrolled resident goose populations have the potential to (a) develop epizootic outbreaks of avian diseases that could spread to wild migratory birds and

(b) create problems with the public that would result in negative attitudes toward geese.[1]

Figure 2. High populations of resident Canada geese can cause environmental problems and impact recreation at Corps projects, especially near urban areas

Populations of resident Canada geese can have detrimental impacts on wetland revegetation and erosion control projects. Allen (1990) reported that the feeding activity of a large population of Canada geese prevented the establishment of herbaceous vegetation along shorelines at Holmes Lake, Nebraska. Waterfowl depredations on grain crops can also be a concern where there are large wintering populations on Corps lakes. Although continental waterfowl populations have declined significantly during the past two decades, crop damage remains a problem in some areas (Knittle and Porter 1988). It has been estimated that giant Canada geese populations have increased by approximately 680 percent since 1970 (Bortner et al. 1991).

Beaver damage

Beaver populations in the eastern United States have increased significantly since the 1950s as the result of low fur prices, increased legal protection, and extensive translocations (Schwille 1985, Willging and Sramek 1989). Although beavers are a major component of freshwater ecosystems and play an important role in maintaining wetland diversity, their dam-building and feeding activities often place them in conflict with humans. Problems include beaver-induced flooding of private property, agricultural areas, timber stands, and roads; damage to earthen dams caused by burrowing activity; and girdling of trees in orchards and residential areas (Arner and Dubose 1982; Loven 1985; Schwille 1985; Woodward, Hazel, and Gaffney 1985; Payne and Peterson 1987).

Corps projects often support large beaver populations, and beaver ponds are common features of backwater areas and other low-lying sites. Beaver ponds are commonly managed for waterfowl, especially wood ducks (*Aix sponsa*) and black ducks (*Anas rubripes*), and provide benefits for numerous nongame wetland species. However, beavers frequently block water-control structures and culverts, which can affect the operation of managed subimpoundments and increase maintenance costs (Buech 1985). Marina owners in Texas reported that beavers often destroy styrofoam flotation blocks and gnaw wooden support structures, causing portions of marinas to sink (Loven 1985). Lake Ouachita, Arkansas, is presently experiencing problems with beaver and river otter (*Lutra canadensis*) activity at marinas and other concessions around the lake. Beavers routinely gnaw on styrofoam flotation blocks, gasoline lines, and other structures, and river otters have been reported to excavate den cavities in the styrofoam.[2]

Wildlife diseases

Several species of wild birds and mammals harbor diseases that are transmissible to humans (referred to as "zoonoses"). Well over 100 zoonoses are known from the United States, but most do not result in serious illness and may even go unnoticed if contracted. However, there are several highly contagious mammalian diseases of national concern that can create problems on Corps projects. These include Lyme disease, Rocky Mountain spotted fever, rabies, tularemia (rabbit fever, trapper fever), plague, and brucellosis

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1 Personal Communication, April 1991, James E. Forbes, U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Animal Damage Control, Albany, NY.

2 Personal Communication, November 1991, Brenda M. Meeks and Lisa K. Wright, Lake Ouachita, Arkansas; U.S. Army Engineer District, Vicksburg.

(Bang's disease, undulant fever) (Robinson and Bolen 1989). The most important human diseases associated with birds in the United States are histoplasmosis, encephalitis, chlamydiosis (also referred to as psittacosis, ornithosis, or parrot fever), and cryptococcosis (Krzysik 1987). Shistosomiasis (swimmer's itch) also requires an avian vector in its life cycle.

Since most Corps projects are popular public recreation areas, disease exposure risks can occasionally be high, especially where dense populations of wildlife species are located in the vicinity of campgrounds, boat landings, and other heavily used areas. Krzysik (1987) stated that certain avian diseases are potential health hazards at Civil Works projects because of the bird species usually present and site/habitat characteristics. A brief discussion of selected diseases is provided below.

Lyme disease is an important arthropod-borne disease associated with deer populations that is spreading rapidly throughout the United States. The causative organism (*Borrelia burgdorferi*) is a spiral-shaped bacterium that is transmitted by the bite of infected ticks. The primary vectors are members of the genus *Ixodes*, which commonly infest white-tailed deer (*O. virginianus*) populations. Certain rodents, primarily the white footed mouse (*Peromyscus leucopus*) serve as reservoirs for the disease (Mello 1989, Johnson 1992). Lyme disease is a serious problem on several military installations and has been documented for Corps projects in the East. An outbreak of Lyme disease at a project has the capability of impacting recreational activities over a long period of time.

Rabies is another disease transmitted by wild animals that is a particular concern in many areas. Most wild mammals can be infected with the rabdovirus responsible for the disease. However, species that are most susceptible to the disease are skunks (*Mephitis* spp. and *Spilogale* spp.), red fox (*Vulpes vulpes*), gray fox (*Urocyn cinereoargenteus*), bats, coyote (*Canis latrans*), and raccoon (*Procyon lotor*) (Robinson and Bolen 1989). Rabies outbreaks among skunk populations occur throughout North America but are most prevalent in the central states. Skunks are highly susceptible, and once the disease is established in the population, it can spread rapidly. Raccoon rabies has recently become a serious problem in suburban areas of the East and Southeast (Bigler et al. 1975). Like Lyme disease, rabies generally threatens the public in areas where the potential for contact between humans and host animals is high.

Outbreaks of tularemia may occur in cottontail, muskrat, nutria (*Myocastor coypus*), and beaver populations. The disease is a threat to the public, but infection is generally limited to trappers and hunters (Robinson and Bolen 1989). Two forms of the disease are transmissible to humans. Cottontails carry the "sylvatic" form, whereas beavers and muskrats carry the "aquatic" form. The aquatic form affects humans more severely and is sometimes fatal. Transmission may occur via blood-sucking arthropods (ticks and fleas), ingested prey, and contaminated water. Trappers are especially susceptible to contracting the disease via open cuts if they do not follow proper safety precautions when skinning their catch. Tularemia occurs nationwide, but the greatest numbers of cases are usually reported from Arkansas, Louisiana, Oklahoma, and Texas.

Several wildlife diseases that are not transmissible to humans are also a source of concern at Corps projects. Duck viral enteritis (DVE, duck plague) and avian cholera outbreaks periodically occur on bodies of water that support large populations of waterfowl (Bellrose 1980, Brand 1987, Friend 1987, Robinson and Bolen 1989). These diseases are highly infectious and can cause widespread mortality in a short period of time. Control is difficult if the outbreak is not detected during the early stages, because migratory birds may rapidly transmit the disease over extensive geographic areas. Generally, outbreaks are most common where large flocks of waterfowl are restricted to small, open bodies of water (Cohn 1991) (Figure 3). The upper Midwest has historically been a high-risk area because many lakes and ponds either partially or completely freeze over during the winter, forcing ducks and geese to concentrate on bodies of water that remain open (Brand 1987, Locke and Friend 1987). Since Civil Works projects provide important waterfowl habitats and seasonally harbor large numbers of birds, the Corps has an opportunity to play a significant role in

contributing to the reversal of waterfowl declines by curtailing the transmission of infectious diseases.

Figure 3. Disease outbreaks and widespread mortality can occur where large flocks of waterfowl are restricted to small, open bodies of water

Proposed Study

A study to examine and develop procedures for resolving wildlife-human conflicts at operational projects is proposed as part of the U.S. Army Corps of Engineers Natural Resources Research Program. The concept, approach, and major elements of the study are described below.

Objectives

Major objectives of the work unit are to (a) assess the status and magnitude of wildlife-human conflicts at Corps projects, (b) determine factors responsible for conflicts and adverse wildlife-human interactions, and (c) develop management strategies that can be implemented to alleviate or minimize conflicts.

Approach

The proposed study will consist of an extensive effort to assess wildlife-human conflicts at operational projects and provide technology and procedures that can be used to resolve problems by project personnel. Specific tasks are as follows:

a. Identification of existing and potential wildlife-human conflicts at Corps projects.

b. Development of methods to analyze conflicts and determine the factors responsible.

c. Survey of techniques used to alleviate/minimize conflicts.

d. Field assessment of specific problems on selected projects.

e. Development of management strategies and techniques to resolve conflicts.

f. Preparation of a guidance document on problem analysis and resolution.

The study will be initiated by extensive coordination with District and project personnel to identify wildlife-human problems that exist on Corps lands. This will include a questionnaire requesting information on types of problems, severity of problems, and possible causes, if known. Based on results of the survey, conflicts will be categorized and priorities established for further investigation.

A detailed literature search will be conducted for information on conflicts, and specialists from other agencies, organizations, and universities will be contacted for technical assistance. This will include the assimilation of information on factors responsible for conflicts, methods appropriate for analyzing problem situations, and techniques available to alleviate or minimize conflicts. Based on a preliminary survey of the literature, factors that contribute to various wildlife-human conflicts include overpopulation, habitat reduction/deterioration, habitat conversion actions (e.g., converting rangeland to row crops), adjacent land use changes (e.g., timber harvest, suburban expansion), improper location of roads and structures, and increased human activity.

Methods will be developed to track activities and conditions that could lead to wildlife-human conflicts. For example, a new road constructed along a project boundary where deer populations are known to be high can be expected to create the potential for increased wildlife-vehicle collisions; improperly located habitat improvement projects on project lands can have a similar effect. Also, a rapidly expanding population of

resident Canada geese near highly used recreational sites will likely result in conflicts in future years. Thus, methods will be needed to assess on- and off-project land uses, habitat changes, and population levels of species that could be affected. The use of routine wildlife inventories will be examined as a potential strategy for detecting population changes that could lead to conflicts.

A variety of techniques for dealing with wildlife problems have been developed and tested on public and private lands. These include trapping and relocation, special fencing, road closures during high-conflict periods, signing (designating wildlife crossings and reducing speed limits during nesting and wintering seasons), diversionary feeding (baiting animals away from hazardous crossings or areas where depredations are a problem), use of repellents, hazing (use of firecrackers, acetylene cannons, distress calls, and reflectors), sterilization, habitat manipulation, increased hunting pressure and special seasons, and elimination of problem animals by damage control professionals. The potential use of these and other methods will be evaluated for application on Corps lands, and selected techniques will be tested on projects where there are known problems. An essential part of any management strategy will be to educate the public to recognize and avoid problem situations.

The final product for the work unit will be a guidance document on evaluating problems and implementing management strategies to resolve wildlife-human conflicts. The report will include the results of demonstration projects where techniques were tested on Corps lands. Status reports will be prepared annually, and interim results will be published in *RECNOTES* and other appropriate media. Throughout the study, coordination with District and project personnel will be maintained to ensure that the products developed provide maximum benefits to the Corps.

Benefits

Numerous cases of wildlife-project operations-public use conflicts have been documented on Corps lands. A thorough assessment of the situation, analysis of factors responsible for conflicts, and development of strategies to alleviate or minimize conflicts will allow project managers to deal with these problems proactively and avoid adverse public reaction. The early identification and resolution of wildlife-human conflicts will result in significant cost savings at projects where these problems exist. The natural resources stewardship image of the Corps of Engineers would likewise be improved with conservation agencies and the public.

References

Allen, H. H. 1990. Biotechnical reservoir shoreline erosion. *Wildlife Resource Notes* 8(1):1-12. U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Alverson, W. S., Waller, D. M., and Solheim, S. L. 1988. Forests too deer: Edge effects in northern Wisconsin. *Conservation Biology* 2:348-358.

Anthony, R. C., and Fisher, A. R. 1977. Wildlife damage in orchards—A need for better management. *Wildlife Society Bulletin* 5:107-112.

Arner, D. H., and Dubose, J. S. 1982. The impact of beaver on the environment and economics in the southeastern United States. *Transactions of the International Congress of Game Biologists* 14:241-247.

Austin, D. D., and Urness, P. J. 1989. Evaluating production losses from mule deer depredation in apple orchards. *Wildlife Society Bulletin* 17:161-165.

Barnes, T. G., Keyser, E. T., III, and Linder, R. L. 1989. Survey of animal damage and feeding selectivity in eastern South Dakota shelterbelts. *Proceedings, Ninth Great Plains wildlife damage control workshop.* Publication 127. A. J. Bjugstad et al., eds. 154-159. Great Plains Agricultural Council, Wildlife Resources Commission.

Bellrose, F. C. 1980. *Ducks, geese and swans of North America.* 3d ed. Stackpole Books, Harrisburg, PA.

Bigler, W. J., Jenkins, J. H., Aumbie, P. M., Hoff, G. C., and Prather, E. C. 1975. Wildlife and environmental health: Raccoons as indicators of zoonoses and pollutants in southeastern United States. *Journal of American Veterinary Association* 167:592-597.

Bortner, J. B., Johnson, F. A., Smith, G. W., and Trost, R. E. 1991. 1991 status of waterfowl and flight forecast. Canadian Wildlife Service and U.S. Fish and Wildlife Service Report.

Brand, C. J. 1987. Duck plague. *Field guide to wildlife diseases*. U.S. Fish and Wildlife Service Resource Publication 167. M. Friend, ed. 117-128.

Buech, R. R. 1985. Beaver in water impoundments: Understanding a problem of water-level manipulation. *Proceedings, water impoundments for wildlife: A habitat management workshop*. USDA Forest Service General Technical Report NC-100. 95-105.

Cohn, J. P. 1991. New focus on wildlife health. *BioScience* 41:448-450.

Conover, M. R. 1989. Relationships between characteristics of nurseries and deer browsing. *Wildlife Society Bulletin* 17:414-418.

Conover, M. R., and Chasko, C. G. 1985. Nuisance Canada geese problems in the eastern United States. *Wildlife Society Bulletin* 13:228-233.

Friend, M. 1987. Avian cholera. *Field guide to wildlife diseases*. U.S. Fish and Wildlife Service Resource Publication 167. M. Friend, ed. 69-82.

Hansen, C. S. 1983. Costs of deer-vehicle accidents in Michigan. *Wildlife Society Bulletin* 11:161-164.

Hygnstrom, S. E., and Craven, S. R. 1988. Electric fences and commercial repellents for reducing deer damage in cornfields. *Wildlife Society Bulletin* 16:291-296.

Ishmael, W. E., and Rongstad, O. J. 1984. Economics of an urban deer removal program. *Wildlife Society Bulletin* 12:394-398.

Johnson, W. A. 1992. Report on Lyme disease prepared for U.S. Army Corps of Engineers field personnel. Miscellaneous Paper R-92-1. U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Knittle, E. C., and Porter, R. D. 1988. Waterfowl damage and control methods in ripening grain: An overview. Fish and Wildlife Technical Report 14. U.S. Fish and Wildlife Service.

Krzysik, A. J. 1987. A review of bird pests and their management. Technical Report REMR-EM-1. U.S. Army Construction Engineering Research Laboratory, Champaign, IL.

Locke, L. N., and Friend, M. 1987. Avian botulism. *Field guide to wildlife diseases*. U.S. Fish and Wildlife Service Resource Publication 167. M. Friend, ed. 83-94.

Loven, J. E. 1985. Reported beaver damage and control methods. *Proceedings, Seventh Great Plains wildlife damage control workshop*. D. F. Fagre, ed. 145-151. Great Plains Agricultural Council, Wildlife Resources Commission.

Martin, C. O. 1989. Management of waterfowl habitats at Corps of Engineers projects. *Proceedings, 14th annual meeting, Natural Resources Research Program*. Miscellaneous Paper R-89-1. 84-95. U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Mello, K. 1989. Lyme disease—Precautions for natural resources personnel. *Wildlife Resource Notes* 7(2):4-6. U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Payne, N. F., and Peterson, R. P. 1987. Trends in complaints of beaver damage in Wisconsin. *Wildlife Society Bulletin* 14:303-307.

Porter, W. F., Mathews, N. E., Underwood, H. B., Sage, R. W., Jr., and Behrend, D. F. 1991. Social organization in deer: Implications

for localized management. *Environmental Management* 15:809-814.

Robinson, W. L., and Bolen, E. G. 1989. *Wildlife ecology and management*. 2d ed. Macmillan Publishing, New York.

Schwille, E. M. 1985. Beaver problems associated with conservation activities. *Proceedings. Seventh Great Plains wildlife damage control workshop*. D. F. Fagre, ed. 49-51. Great Plains Agricultural Council, Wildlife Resources Commission.

Shoten, H. 1988. Farmstead shelterbelts—Protection against wind and snow. Bulletin NR-BU-0468. Minnesota Extension Service, St. Paul.

Willging, B., and Sramek, R. 1989. Urban beaver damage and control in Dallas-Fort Worth, Texas. *Proceedings. Ninth Great Plains wildlife damage control workshop*. Publication 127. A. J. Bjugstad et al., eds. 77-84. Great Plains Agricultural Council, Wildlife Resources Commission.

Wood, P., and Wolfe, M. L. 1988. Intercept feeding as a means of reducing deer-vehicle collisions. *Wildlife Society Bulletin* 16:376-380.

Woodward, D. K., Hazel, R. B., and Gaffney, B. P. 1985. Economic and environmental impacts of beavers in North Carolina. *Proceedings, Second Eastern wildlife damage control conference*. P. T. Bromley, ed. 89-96.

Development of a Corps-wide Wildlife and Habitat Resources Inventory Database

by
Chester O. Martin[1]

Introduction

An important aspect of the multiobjective Civil Works mission of the U.S. Army Corps of Engineers is the stewardship of the land and water held in public trust. These lands, approximately 11 million acres on over 460 projects nationwide, contain a wealth of natural resources subjected to a variety of activities. The management of game and nongame wildlife and their habitats on project lands is a major facet of the Corps' natural resources management program, as indicated by the more than 3.5 million acres of land and water that are presently under some form of wildlife management on operational projects (Martin 1986).

Just as patterns of recreation use guide management decisions on Corps lands, so must the patterns of wildlife use guide habitat management. As the Corps strives to accomplish its new environmental mission, it is critical that appropriate habitat and wildlife inventories be executed on lands under Corps ownership. This information is frequently needed at the District, Division, and Headquarters levels as the Corps takes an increasingly active role in the environmental arena and has a greater need to base management decisions on sound ecological data. A nationwide strategy and accompanying methodologies are needed to develop a standardized Corps wildlife and habitat database for operational projects; the information resulting from such a database will facilitate the decision-making process and provide for better natural resources stewardship on Corps lands throughout the nation.

Background

In the early 1980s, the Secretary of the Army appointed a "Blue Ribbon Panel" to evaluate natural resources management programs on military installations and Civil Works projects. This study found that inventory data were lacking on projects throughout the nation and strongly recommended that new or more adequate natural resource inventories be completed, with the resulting information to serve as the base for preparing integrated resource management plans; it was further advised that better use be made of up-to-date systems for assessing and managing natural resources (Jahn, Cook, and Hughes 1984). Some Districts have developed in-house procedures for delineating habitats and estimating populations of key wildlife species on their lands. However, wildlife and habitat inventory data remain inconsistent and are sometimes almost entirely lacking at Corps projects.

Existing surveys

Habitat information on operational projects traditionally consists of forest stand/compartment data, noxious weed surveys, wetland inventories, and habitat delineation and mapping by broad cover types. Geographic Information Systems (GISs) are being used to collect and display data on land uses and habitat types on some projects, but programs and methods are highly variable among Districts. Existing wildlife surveys may include big game inventories (especially for deer, *Odocoileus* spp., and elk, *Cervus canadensis*); nesting surveys of Canada geese (*Branta*

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

canadensis), wood ducks (*Aix sponsa*), and ospreys (*Pandion haliaetus*); counts of endangered species such as wintering bald eagles (*Haliaeetus leucocephalus*); hunter/harvest data for major game species and furbearers; and observational data on species occurrence. Some projects also participate in wintering waterfowl surveys and may conduct call count and/or flushing count surveys for game birds (Johnson 1984, Bahus 1985, Earls 1985, Watkins 1988, Karas 1989, Piehler and Fowles 1989).

The studies cited above indicate the variety of wildlife and habitat surveys being conducted at Corps projects and the need to collect inventory data for management purposes. Most projects have delineated and mapped major vegetation types, and periodic surveys are conducted to obtain population and/or habitat quality data for selected high-interest species. However, information is often not comparable among projects and Districts because methods for collecting and displaying data have not been standardized.

A program to standardize inventory data for all operational projects within a District has recently been implemented by the U.S. Army Engineer District, Vicksburg. In 1989 the District sponsored a study with the Environmental Laboratory, U.S. Army Engineer Waterways Experiment Station (WES), to conduct a survey of wildlife inventory procedures that could be used on operational projects in Mississippi, Arkansas, and Louisiana. The study was needed because information on the population status of significant wildlife species was required to complete their project Operational Management Plans (OMPs). However, adequate wildlife census data were not available for these projects. A study was designed by WES and coordinated with the District and the Lower Mississippi Valley Division. It involved the following major tasks: (a) District/Division coordination and selection of species; (b) review and assessment of available methods; (c) pilot study at Grenada Lake, Mississippi, to test methods and procedures; (d) report on assessment of methods, results of the pilot study and recommendations for Corps lands; and (e) training session for project personnel on the application of wildlife census techniques and analysis/interpretation of results (Martin 1992).

Inventory methods were developed and tested for the following species and species groups in the Vicksburg study: northern bobwhite (*Colinus virginianus*), mourning dove (*Zenaida macroura*), eastern bluebird (*Sialis sialis*), wood duck, eastern cottontail (*Sylvilagus floridanus*), squirrels (*Sciurus species*), white-tailed deer (*O. virginianus*), and furbearers. Recommendations were also provided for censusing the wild turkey (*Meleagris gallopavo*), bald eagle, and wintering waterfowl. Each method included step-by-step procedures for conducting surveys, analyzing data, and processing/summarizing data for project and District use. This information was provided in a training notebook developed for the District training session (Environmental Laboratory 1991). Project personnel are currently using guidelines developed through this study to conduct routine wildlife inventories on their lands. Future plans for wildlife inventories include the development of computer software and a GIS program for inputting and displaying wildlife data.[1]

Rationale for inventories

The need for conducting inventories on Federal lands was discussed by Wondra (1990) for National Park Service lands, and applies to Corps resources as well. Wondra stated that it is essential that park managers know the condition of the resources under their care and have a means of detecting and documenting changes. This was said to be especially critical with parks becoming increasingly surrounded by altered environments and experiencing externally caused impacts on their resources, along with growing impacts of human activity within park boundaries. It was further stated that, to determine appropriate management actions, park managers must know what resources they have, how they interrelate, how they change over time, and how those changes correlate with modern human activities. The application of GIS programs to delineate resources and assess habitat changes was described for Park Service lands (Wondra 1990).

[1] Personal Communication, July 1991, Julie Marcy, Natural Resources Management Branch, Operations Division, U.S. Army Engineer District, Vicksburg.

Effective habitat management for both game and nongame animals requires a knowledge of the population status of those species on the parcel of land being managed. Obtaining accurate estimates of wildlife populations is considered a major objective of most management programs (McCullough and Hirth 1988), and a knowledge of population size is critical to an understanding of biological parameters and processes within a management area. For example, population data can help the manager understand how predation, hunting pressure, disease, climate, land use practices, and other factors affect the health of his wildlife resources. If a population is subject to management, for either harvest or protection, a reliable estimate of population size is especially desirable (Novak et al. 1991).

The natural resources manager, like the business manager, should maintain a continuous inventory of his/her stock (i.e., gains and losses). This enables him to evaluate the results of his management program, plan future actions, and make cost-effective decisions based on dependable information. As a major land manager, a provider of public hunting lands, and a steward of natural resources, the Corps has an inherent responsibility to maintain the quality of existing habitats to support optimum populations of native wildlife species. This is difficult to achieve in the absence of reliable census data.

Limitations/difficulties

Conducting habitat inventories and censusing free-roaming, wild animal populations requires careful planning, preparation, and execution of techniques. The methods chosen will be influenced by constraints of time and cost, objectives of the census, the desired level of accuracy, and terrain and habitat features. Problems often noted as limitations associated with conducting inventories on Corps lands are noted below:

a. Methods recommended by the scientific community are often too expensive and time-consuming for routine surveys on Corps lands. The more reliable and statistically valid methods are generally very costly and are justifiable only in research or where there is special concern regarding the population of a sensitive species.

b. Many of the commonly used census techniques were designed to inventory populations on continuous tracts of land designated for the purpose of wildlife management. Thus, the fragmented nature of most Corps projects makes it difficult to implement standard inventory techniques. Poor access and irregular boundaries also limit the effective application of some methods.

c. Corps rangers are responsible for a variety of tasks associated with the day-to-day operation of reservoir projects and may have limited time available to conduct inventories. The inflexible work schedule at some projects also makes it difficult to conduct wildlife surveys during the proper time of day or night. This can be a significant problem because a delay of even 30 min past the peak activity period of an animal can drastically affect the results of a census.

d. Project personnel may not have the background and training needed to design and conduct vegetation and wildlife inventories. This is highly variable and depends on the ranger's formal education and experience.

e. Wildlife and habitat management programs are frequently of low priority at operational projects, even with the recent emphasis on natural resources stewardship.

f. Many Districts and projects question their authority and/or obligation to conduct wildlife surveys on O&M projects. Corps policy regarding wildlife management and associated actions remains vague and is subject to highly variable interpretation.

g. Some Districts are of the opinion that they should rely entirely on State fish and wildlife/conservation agencies for information on wildlife populations. However, State offices continually experience budgetary constraints and do not have the personnel resources

available to conduct routine wildlife and habitat inventories on Corps lands.

The above list includes both technical and institutional concerns regarding wildlife and habitat inventories. From a technical perspective, the majority of wildlife census techniques that can be realistically applied on Corps lands will result in an index to population size rather than an estimate of absolute density (Martin 1992). Although indices are not generally capable of detecting subtle changes, they are useful for monitoring trends over time or for comparing relative abundance among populations (Wakeley, Roberts, and Martin 1990). By censusing the same area over a period of years, it is usually possible to determine if populations are increasing, decreasing, or remaining stable.

Proposed Study

A project to develop a Corps-wide wildlife and habitat resources inventory database is proposed as part of the U.S. Army Corps of Engineers Natural Resources Research Program (NRRP). The concept, study approach, and major tasks are described below.

Objectives

Major objectives of the work unit are to (a) develop standardized techniques in support of systematic wildlife and habitat resource inventories and (b) develop a Corps-wide database and access format for storing, retrieving, and summarizing wildlife and habitat data. The database will include information on habitat types, land use categories, wildlife use, and population data.

Approach

Basic requirements for an effective inventory program include standardized census/survey methods, standardized habitat codes, development of programs for data analysis, provision of training on the implementation of inventory methods and interpretation of results, and development of different levels of database outputs that can be used for upward reporting. The proposed study will involve the following major tasks, which are designed to address these needs:

a. Corps-wide survey of existing inventory information.

b. Evaluation of methods available to inventory habitats and wildlife populations.

c. Development of a database format and program for storing, retrieving, summarizing, and displaying inventory data.

d. Field testing of selected methods at Corps projects.

e. Development of a guidance document on the implementation of wildlife and habitat inventories.

The work unit will be initiated with a survey of wildlife and habitat inventories available at Corps projects. An assessment will also be made of methods used and application of results. A thorough literature survey will be conducted to identify methods used by researchers and other land management agencies and to evaluate the potential for applying these techniques on Corps lands.

The procedure for evaluating techniques will be similar to that used in the Vicksburg District study. For example, methods examined for censusing white-tailed deer populations included drive counts (Overton 1971; McCullough 1979; Tilton, Teer, Silvy 1987), hahn-deer cruise (Teer 1984), spotlight census (Melchiors, Thackston, and Stobaugh 1985; Mitchell 1986a), track counts (Mooty 1980, Mitchell 1986b), aerial census (Beasom 1979; Melchiors, Thackston, and Stobaugh 1985), pellet group counts (Stormer et al. 1977, Mooty 1980, Creed et al. 1984), mark-recapture techniques (Hayne 1984, McCullough and Hirth 1988), harvest survey data (Creed et al. 1984, Hayne 1984), browse surveys (Lay 1967), and habitat-based methods (Short 1986).

The spotlight census was chosen for project lands because it has been shown to provide good trend data on deer densities in the Southeast and results in a large sample that can be obtained with a minimum investment of manpower. It was also suggested that these data be supplemented with browse surveys and available deer harvest data.

As previously discussed, wildlife inventory methods were field tested for several species in the Vicksburg District study, and guidelines for collecting, analyzing, and interpreting data were provided in a field training notebook. Techniques for additional species will require testing in the proposed project to determine their suitability for use on project lands. Some techniques will need to be examined in respect to suitability for application based on differences in geographic regions and habitat types.

After inventory methods are evaluated, standardized methods will be selected and a database format and program will be developed for storing and processing data. This will be initiated with an assessment of existing programs that are being used by other agencies and organizations. Where possible, existing methods will be modified for Corps use rather than creating new programs. The database format will be designed to be easily incorporated into a GIS format. The system will be fully tested on selected projects, and procedures will be developed to process and summarize information as needed at various hierarchical levels within the Corps of Engineers. The final report for the work unit will be a guidance document on the implementation of wildlife and habitat inventories and accompanying database format on Corps lands.

Benefits

Wildlife and habitat inventory information is needed at all levels within the Corps. Detailed surveys are needed for management purposes at the project and District levels, while District, Division, and Headquarters, USACE, offices frequently need summary information. The proposed study will result in the provision of guidelines for implementing appropriate inventory methods on Corps projects and development of an operational database format and program that processes information for use throughout the Corps.

References

Bahus, K. L. 1985. A study of wintering bald eagles on the upper Mississippi River. *Wildlife Resource Notes* 3(1):2-3. U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Beasom, S. L. 1979. Precision in helicopter censusing of white-tailed deer. *Journal of Wildlife Management* 43:777-780.

Creed, W. A., Haberland, F., Kohn, B. E., and McCaffery, K. R. 1984. Harvest management: The Wisconsin experience. *White-tailed deer: Ecology and management.* L. K. Halls, ed. 243-260. Stackpole Books, Harrisburg, PA.

Earls, G. 1985. SWD applications of remote sensing technology to resource management. *Wildlife Resource Notes* 3(1):5-6. U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Environmental Laboratory. 1991. Development of wildlife inventory procedures for project lands of the USAE Vicksburg District: Field training notebook. Report and notebook prepared for U.S. Army Engineer District, Vicksburg, by U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Hayne, D. H. 1984. Population dynamics and analysis. *White-tailed deer: Ecology and management.* L. K. Halls, ed. 203-210. Stackpole Books, Harrisburg, PA.

Jahn, L. R., Cook, C. W., and Hughes, J. D., Jr. 1984. An evaluation of U.S. Army natural resources management programs on selected military installations and Civil Works projects. Report to Secretary of the Army, U.S. Department of the Army, Washington, DC.

Johnson, M. S. 1984. Record eagle count on the Arkansas River. *Wildlife Resource Notes* 2(1):1-2. U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Karas, C. D. 1989. Corps of Engineers Canada goose nest survey of the mid-Columbia River. *Wildlife Resource Notes* 7(1):3-4. U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Lay, D. 1967. Deer range appraisal in eastern Texas. *Journal of Wildlife Management* 31:426-432.

Martin, C. O. 1986. Chapter 1: Introduction, U.S. Army Corps of Engineers Wildlife Resources Management Manual. Technical Report EL-86-25. U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Martin, C. O. 1992. Development of wildlife inventory procedures for Corps Operations and Maintenance (O&M) projects. *Proceedings, 16th annual meeting, Natural Resources Research Program.* Miscellaneous Paper R-92-2. 17-24. U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

McCullough, D. R. 1979. *The George Reserve deer herd: Population ecology of a K-selected species.* University of Michigan Press, Ann Arbor, MI.

McCullough, D. R., and Hirth, D. H. 1988. Evaluation of the Peterson-Lincoln estimator for a white-tailed deer population. *Journal of Wildlife Management* 52:534-544.

Melchiors, M. A., Thackston, R. E., and Stobaugh, D. G. 1985. Results of spotlight and helicopter deer surveys. *Proceedings, annual conference, Southeastern Association of Fish and Wildlife Agencies* 39:506-511.

Mitchell, W. A. 1986a. Deer spotlight census: Section 6.4.3, U.S. Army Corps of Engineers Wildlife Resources Management Manual. Technical Report EL-86-53. U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Mitchell, W. A. 1986b. White-tailed deer track count census: Section 6.4.2, U.S. Army Corps of Engineers Wildlife Resources Management Manual. Technical Report EL-86-52. U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Mooty, J. J. 1980. Monitoring deer populations in the northern forested areas of the Midwest. *White-tailed deer population management in the north central states.* R. L. Hine and S. Nehls, eds. 13-22. The Wildlife Society, North Central Section.

Novak, J. M., Scribner, K. T., Dupont, W. D., and Smith, M. H. 1991. Catch-effort estimation of white-tailed deer population size. *Journal of Wildlife Management* 55:31-38.

Overton, W. S. 1971. Estimating the numbers of animals in wildlife populations. *Wildlife management techniques manual.* 3d ed., 2d printing, rev. R. H. Giles, Jr., ed. 403-455. The Wildlife Society, Washington, DC.

Piehler, K. G., and Fowles, J. M. 1989. Wood duck nest box use on Corps lands in the Pittsburgh District. *Wildlife Resource Notes* 7(3):2-4. U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Short, H. L. 1986. Habitat suitability index models: White-tailed deer in the Gulf of Mexico and South Atlantic Plains. U.S. Fish and Wildlife Service Biological Report 82(10.123). Washington, DC.

Stormer, F. A., Hoekstra, T. W., White, C. M., and Kirkpatrick, C. M. 1977. Frequency distribution of deer pellet groups in southern Indiana. *Journal of Wildlife Management* 41:779-782.

Teer, J. G. 1984. Lessons from the Llano Basin, Texas. *White-tailed deer: Ecology and management.* L. K. Halls, ed. 261-290. Stackpole Books, Harrisburg, PA.

Tilton, D. A., Teer, J. G., and Silvy, N. J. 1987. Accuracy and precision of line transect procedures for white-tailed deer. *Proceedings, annual conference, Southeastern Association of Fish and Wildlife Agencies* 41:424-431.

Wakeley, J. S., Roberts, T. H., and Martin, C. O. 1990. Auditory survey techniques: Section 6.3.5, U.S. Army Corps of Engineers Wildlife Resources Management Manual. Technical Report EL-90-7. U.S. Army Engineer

Waterways Experiment Station, Vicksburg, MS.

Watkins, M. A. 1988. Use of habitat appraisal guides in the Kansas City District. *Wildlife Resource Notes* 6(2):1-2. U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Wondra, P. 1990. Using Geographic Information Systems to manage natural resources. *Trends* 27(4):38-42. U.S. Department of the Interior, National Park Service, National Recreation and Parks Association.

Effects of Reservoir Operations on Recreational Fisheries

by
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Introduction

Angling is so popular in Corps of Engineers reservoirs (U.S. Fish and Wildlife Service 1989) that understanding the influence of reservoir operations on recreational fisheries has become critically important. This study examines the linkage between reservoir operation and recreational fisheries in warmwater reservoirs operated primarily for flood control and hydropower and for which suitable databases exist. The anticipated benefits of this study include: (a) a better understanding of factors determining recreational fisheries potential in Corps of Engineers reservoirs, (b) characterizing relationships between reservoir operations and recreational use, and (c) operational strategies that minimize adverse effects on recreational fisheries.

Objectives

Objectives for this study are to (a) characterize the recreational fishery in selected warmwater reservoirs operated by the Corps of Engineers and (b) evaluate the impact of reservoir operations on recreational fisheries. If reservoir operations negatively influence recreational fisheries, studies will be developed to test operating strategies that minimize these disturbances.

Procedures

During FY92-93, biotic and abiotic information will be collected and evaluated for selected warmwater reservoirs. Initial analysis will evaluate usable information from Corps of Engineers, U.S. Environmental Protection Agency, and National Reservoirs Research Program databases. Table 1 lists potential biotic and abiotic attributes evaluated to determine harvest potential and factors affecting the recreational fishery. Once the database has been collected and analyzed, two products will be developed.

Table 1
Biotic and Abiotic Factors Potentially Influencing the Recreational Fishery Potential of Corps of Engineers Reservoirs Managed for Hydropower and Flood Control

Abiotic Factors	
Depth	Outlet depth
Shoreline development	Growing season
Retention time	Reservoir use
Age	Volume
Mean annual fluctuation	Watershed area
Area	Drainage area
Total dissolved solids	Turbidity
Biotic Factors	
Proximity to cities	Harvest
Species richness	Boat access
Angler attitudes	Standing crop

Product 1

The first product is the characterization of the recreational fishery of Corps of Engineers reservoirs where suitable information exists. This evaluation will describe the recreational fisheries based on standing crops of sport fishes, potential yields, and species composition. The evaluation will be developed either from historical information (e.g., creeling data) or from regression equations relating reservoir characteristics with standing crops or yields (Jenkins and Morais 1971, Ploskey et al. 1986). Relationships

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

between fisheries potential and recreational use of a reservoir will be developed. Measures of recreational angling are shown in Table 2. Case studies related to reservoir use and valuation of the recreational fishery are anticipated. The goal of this work unit is to develop models for valuation of recreational fisheries.

Table 2
Measures Used in Modeling the Value of Recreational Angling in Corps of Engineers Reservoirs

• Supply factors: access, facilities, management
• User inputs: time, equipment, costs of durable goods
• Recreational experience: expectations, species sought, skill level
• Satisfaction and benefits: fishing success, companionship, tournament involvement
• External factors: travel distance, nondurable good costs, resource attributes

Product 2

The second product will define relationships between reservoir operations and the recreational fishery potential, i.e., the standing stock of sport fishes and ability to support sustained harvest. A wide variety of biotic and abiotic variables will be collected and evaluated. An initial review of the literature suggests that factors such as biologically available phosphorus, retention time, and reservoir morphology are important. Substantial initial efforts will be needed to group or classify reservoirs into similar categories, such as purpose, retention time, level of productivity, etc. Once these groupings are completed, regression analysis and other analytic tools will be used to isolate the most important factors in determining the recreational fishery potential.

The analysis may suggest that factors determining the potential of the fishery are not readily definable or are too variable to be of use. For example, we may be unable to determine which set of abiotic or biotic variables consistently can be found in recreational fisheries of high potential. However, if the factors are definable, there are two possible outcomes.

The first is that reservoir operation (i.e., mean water level management practices) has little or no influence on the recreational fishery. However, if analysis demonstrates that reservoir operations have the potential to negatively influence fishery potential (Ploskey, Aggus, and Nestler 1985), different operational strategies must be evaluated. Case studies will be initiated on selected reservoirs. The approach would be to collect baseline information before and after operational changes. Improvements in the recreational fishery will be evaluated compared to the costs of operational changes. Figure 1 is the proposed decision-making process for this work unit.

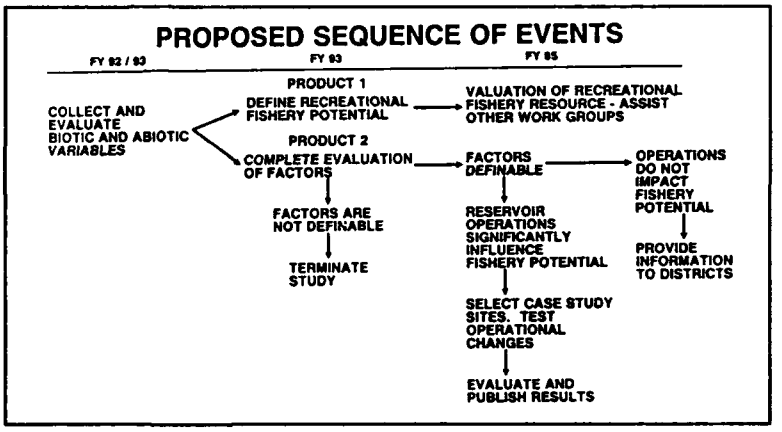

Figure 1. Decision-making process for evaluating costs of operational changes

References

Jenkins, R. M., and Morais, D. I. 1971. Reservoir sportfishing effort and harvest in relation to environmental variables. *Reservoir fisheries and limnology*. G. E. Hall, ed. 359-370. American Fisheries Society Special Publication Number 8.

Ploskey, G. R., Aggus, L. R., and Nestler, J. M. 1985. Effects of reservoir water levels on year class development and abundance of

harvestable fish. Technical Report E-85-5. U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Ploskey, G. R., Aggus, L. R., Bivin, W. M., Jenkins, R. M., and Edsall, T. A. 1986. Regression equations for predicting fish standing crop, angler use, and sport fish yield for United States reservoirs. Administrative Report 86-5. U.S. Fish and Wildlife Service-GLFL.

U.S. Fish and Wildlife Service. 1989. 1985 National survey of fishing, hunting, and wildlife-associated recreation. U.S. Department of the Interior, Washington, DC.

Measuring the Effects of Recreation Fee Programs

by
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Introduction

Widespread levying of fees for public outdoor recreation is a relatively new concept in the United States. With vast amounts of land open for settlement, the idea of use fees for Federal land was not considered appropriate. In a few cases (i.e., Hot Springs National Park), a fee was charged to offset the costs of developing facilities. However, until the 1950s, a tradition of rarely if ever charging for outdoor recreation came to seem to many people a birthright of living in the United States. To understand these feelings today, it is important to review the events that led to the present situation.

Fees or Free?

Behind all the arguments is a philosophical shift in the past 10 years by public officials who feel that those who benefit the most should pay the most. While we all benefit from and pay for the existence of Yellowstone National Park, those actually using the facilities derive greater benefits than those who do not. Therefore, it is argued that they should pay more than those who only read about the park in *National Geographic*. Countering this line of reasoning are those who feel that charging fees closes recreation opportunities to certain socioeconomic classes and ethnic groups. They feel that pricing outdoor recreation opportunities based on the user's ability or willingness to pay takes away from the quality of life for segments of the population. Further, it is argued that those in the middle class are being made to pay twice for their recreation: once as part of income taxes, and again at the fee booth.

The shift from totally free to partially subsidized outdoor recreation has not been a quick or easy one. Perhaps the most vocal persons have been those most immediately impacted. The implementation of widespread entrance fees for many National Park Service (NPS) areas in 1988 led to a great deal of initial opposition by different groups in the travel and tourism sector. They were accustomed to use of public outdoor recreation areas without paying any direct fees. Yet the new fees are a small percentage of the average daily travel cost for most users (when adjusted for inflation) and less than some of the entrance fees that were established in the 1970s.

With the passage of the Land and Water Conservation Fund Act (LWCFA) in 1965, the Corps briefly charged entrance fees at some projects. Public and Congressional opposition were very strong concerning entrance fees at Corps projects. Less than 2 years later, the LWCFA was amended to forbid the Corps to collect fees. Presently, entrance fees are collected only by NPS and some U.S. Fish and Wildlife Service refuges. For the past 5 years, as part of the President's legislative initiative, there has been a proposal to charge fees for some Corps recreation day use areas. During the same period of time there has been a Presidential legislative initiative for the National Forest Service (NFS) that would allow charging of entrance and day use fees at recreation areas under their jurisdiction. However, strong opposition from both special interest groups and Congress has blocked such passage. Any type of fees for day use and entrance fees would require an amendment to the LWCFA.

Prior Research

Background

Interest in researching various issues concerning fees for outdoor recreation has been very cyclical. The first studies were conducted in the

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

depths of the U.S. Depression of the 1930s. With the end of World War II, the economy rapidly expanded, and this period was characterized by extensive subsidization of most recreation services. Not until the early 1960s were fees an issue and therefore again a topic of research and discussion. The LWCFA, which was passed in 1965, attempted to standardize fees and establish one master account for all Federal land management agencies. Another period of heightened interest in fee-related issues was the early 1980s, with an administration that placed an emphasis on privatization of public recreation and budget cuts in many recreation programs. All three periods of interest were driven by Governmental interest in increasing fee revenues. Fees were used to reduce or offset expenditures by the Federal Government and shift recreation funding from all taxpayers to the users of recreational resources.

Fee research perspectives

Most research concerning fees for outdoor recreation has been from an economics perspective. Often using willingness-to-pay (WTP) or similar measures, the studies determine certain "optimum" fees for various activities or projects. While this research approach is important, other factors that are equally important must be considered. WTP measures economic efficiency very well, but does not take into account administrative, psychological, or sociological variables, which also are important influencers of prices.

Fees for outdoor recreation can be examined from five perspectives. None of these stands alone; rather, they are interrelated. These are described below.

- Equity—How do we ensure "fairness" to all concerned? More importantly, what is fair?
- Economics—Determining ideal fee structures.
- Social—How do groups of people feel, think about, deal with, and react to various nonfee and fee issues?
- Psychological—How do individuals deal with fees?
- Political—What are the big "P" and little "P" (formal and informal) networks associated with establishing and increasing fees and the ramifications of those actions?

Numerous interactions occur among the different perspectives. How people feel about fees will influence what political actions are taken. Also, the Federal budget has an effect on fee structures as modified by political action. Other concerns relate to fairness or equity of prices for different population groups. While some individuals will react to changes in fee structures, the driving forces in most cases are the social and political elements.

Numerous studies quantify the amount that people are willing to pay for a certain outdoor recreation experience. However, the attitudes and views of those paying the fees have not been characterized to any extent. It is not understood how people will react when confronted with fees. They may feel they are being asked to pay twice for a service that was until recently paid by general tax revenue. By determining the complex sociological implications of fees, managers will be able to be more effective and responsive in their approach to various fees and fee structures.

Even after there is an understanding of the role of fees and a consensus on the amount to be charged, there is an additional element not often considered: the purpose of fees. To many people in the 1980s, fees came to represent a change in political philosophy. One important concern of the previous and present administrations is reducing subsidies for operation and maintenance costs for recreational facilities. This is being done by increasing the existing fees and instituting new fees where possible. This tends to overlook other important aspects of fees. Fees can increase perceptions of security; change visitation patterns; increase perceptions of value and quality (you get what you pay for); be used during contact to get across safety messages and hazard awareness; increase the number of public programs offered; improve agency awareness (friendly uniformed person in fee booth, etc.), and build support for programs.

Corps Recreation Study

With recreation visitation second only to the NFS, the Corps had little recent in-depth information concerning its role as a recreation provider. In 1989, the Assistant Secretary of the Army (Civil Works) chartered a task force and directed the participants to "appraise the subject of recreation at Corps projects" (U.S. Army Corps of Engineers (USACE) 1990). More specifically, a major portion of the study was to examine present funding strategies for many areas of recreation with the intent to "maintain and enhance the public recreational opportunities at Corps projects while reducing the Federal costs for development and operation of recreation facilities" (p 145). The process used (p 27) was to solicit information and views from a wide range of potentially interested parties, including recreation user groups, recreation providers (both public and private), suppliers of recreation equipment and services, the recreation/tourism industry, potential developers, conservation and environmental organizations, the academic community, and Corps employees.

The information-gathering process for the Corps Recreation Study was extensive and exhaustive. It included five in-house task forces, a telephone survey of organizations, a poll of State Governors and Directors of other Federal land management agencies, personal interviews, workshops at the 1988 Corps Natural Resources Management Conference, and regional workshops. At the regional workshops (USACE 1990, p 29), a preliminary compilation and evaluation of suggested management programs and strategies was then conducted by a working group **consisting of Corps field personnel from various disciplines** [emphasis added]. This working group (of Corps field personnel) compiled all suggested options received, eliminated ideas that were duplicates or that could not meet the study objective, and categorized the remaining options into four categories.

The purpose of the workshops was "to elicit intensive review, in a small, facilitated workshop setting, by individuals representing diverse backgrounds and opinions" (USACE 1990, p 29). Breakout sessions were provided for the exchange of diverse ideas and opinions.

From that in-depth process that involved all levels of the Corps, representatives from each working group prepared evaluations and recommendations. These were reviewed by the field review group and presented to the Recreation Task Force Management Team and Policy Steering Committee. The process described above was then used to prepare a series of recommendations. During the process, over 400 letters were also received from the public, organizations, and other public agencies. All those were considered when the final recommendations were prepared.

Research Problem Delineation

Justification for study

A set of final recommendations was prepared for the 1990 Corps of Engineers Recreation Study. These were based on an intensive, comprehensive, and exhaustive series of data-gathering methods that identified issues critical to the Corps recreation program using input from many directions, as detailed in the previous section of this Plan of Study. This Plan of Study was developed in direct response to recommendation I(b) of that report: Conduct further marketing and demand studies to determine what additional fees would be feasible and at what level (USACE 1990, p 131). The terms "marketing and demand studies" are discussed and defined in the Corps of Engineers Recreation Study (p 120) as follows:

> Approaches to reducing the Federal burden of the Corps recreation program include increasing revenues generated by existing recreation opportunities and broadening the program to provide new opportunities, either by the Corps or by increasing non-Federal public or private management. **In all cases, this requires an understanding of the motivations, preferences and needs of both existing users, who might be impacted by management changes, and potential customers not now served** [emphasis added]...and [referring to working with other agencies] in order to exploit these opportunities when they exist, standard survey

questions should be developed to collect **activity, preference, motivation, and other such data** [emphasis added] to support market analyses.

Problem statement

Attitudes, motivations, and perceptions toward fees of visitors to Corps recreation areas are not well understood. Recent recreation literature suggests that it is important to understand these effects before attempting to develop fee policies. Also, there are no data concerning what impacts the effects of attitudes, motivations, and perceptions of Corps personnel at the field and middle levels have on this problem.

Study purpose

The purpose of this study is to examine and observe social-based variables influencing perceptions of fees at Corps recreation sites. The intention is to provide a more complete understanding for Corps personnel whose responsibilities include any aspect of fees. This will enable them to better understand the impressions of Corps recreation site visitors concerning fees and at the same time better communicate with the visitor concerning the purpose of those fees. The net result will be fewer misunderstandings and more informed decision-making.

Preliminary Study Tasks

Initial investigation

Tasks are to meet with Headquarters, USACE, staff to discuss fee-related issues with regard to the research, and also, to meet with fee representatives from other land management agencies. The purpose is to learn about previous studies, political concerns, and other ongoing related research efforts that may be tied to this research.

Willingness-to-pay survey

This work unit sponsored a survey of day users during summer 1991 at several Corps projects in Texas. Specifically, the survey was designed to produce information to address the following questions:

a. Is there a relationship between visitor perceptions of lake and recreation area quality and potential visitor behavior under different day use fee structures?

b. Is there a relationship between visitor demographics and potential visitor behavior under different day use fee structures?

c. Is there a relationship between the availability of substitute recreation areas and potential visitor behavior under different fee structures?

d. Were visitor perceptions of fees (measured in three questions in the survey) linked to prior use of day use fee areas?

One preliminary finding of this study is that after resistance to an initial fee, there is no statistically significant difference in projected visitation levels at higher prices. This might mean that other factors, in addition to economics, influence visitors' perceptions and reactions to user fees. There are instances in which people are opposed to fees based on psychological, equity, or sociological issues. These factors are equally important when determining effective techniques for the administration of fees for outdoor recreation.

Comprehensive bibliography

A comprehensive bibliography will be developed that documents important fee-related research pertaining to this study. It is intended that this bibliography will be one of the more complete in this subject area. During the remainder of the work unit, this document will be used to reference proposed or ongoing studies and to better understand the complex discussion of fees for outdoor recreation.

Legislative history

The purposes of this task are to provide managers with a better understanding of why the Corps fee program operates as it does today and to identify legislative limitations and prohibitions. The legislative history will provide managers

with a document containing a complete and usable description and analysis of important legislative issues relating to the Corps' fee program. This document will consist of two parts: a compilation of relevant Congressional testimony by the public or Congress relating to Corps fee legislation, and a comprehensive chronology and citation of the numerous revisions of the LWCFA and any related legislation impacting the Corps fee program.

Attitudes, Motivations, and Perceptions Tasks

The purpose of the following three tasks is to study the attitudes, motivations, and perceptions of Corps personnel, and recreational site users and nonusers, concerning outdoor recreation fees. While each task is individually important, it approaches the problem from only one direction. To understand this complex problem, it is necessary to approach it from several research perspectives. Each task builds to some extent on data gathered from the previous task.

Agency attitudes, motivations, and perceptions

A representative sample of Corps personnel who have some interaction with the fee program will be contacted, and data will be collected concerning fee attitudes, motivations, and perceptions. These data are intended to provide a snapshot of the Corps at a particular point in time. The purpose is threefold: to provide the Principal Investigator with personal in-depth knowledge of Corps personnel views on this issue; more importantly, to provide Corps personnel with an understanding of where their personal views fit into the Corps spectrum of views; and to compare and contrast these views with those of users and nonusers of Corps recreation sites. These data are to be gathered by on-site visits with representative Corps officials at various levels of the organization. Additional data to augment this task will be acquired as necessary from mailed questionnaires.

Nonuser attitudes, motivations, and perceptions

This task is intended to examine the attitudes, motivations, and perspectives of the nonusers. The resulting data can be used by managers at several levels to better understand possible opportunities arising from different fee scenarios. This task is important to managers in understanding the changes that have occurred in usage at Corps recreation sites, and why, and the possible fee-related issues that influence visitors' decisions concerning visits to Corps recreation sites. It is anticipated at this time that data collection will concentrate on several areas of the country where Corps projects are clustered.

Gathering data concerning nonusers will help in understanding the question of equity and fees (i.e., are fees one reason people choose not to visit a Corps recreation site?). It will also be possible to gather some additional insight to the reactions to different pricing strategies and whether they make a difference. Where practical, significant issues that apply to this research project identified during the manager survey will be addressed in this portion of the research project.

Recreation site user attitudes, motivations, and perceptions

This task will gather data concerning the self-selected group of visitors that are presently coming to Corps recreation sites and/or recreation sites leased from the Corps. It is intended that data collection will be conducted in the same regions as the nonuser data. The survey instrument used will incorporate relevant questions and findings from the previous tasks. In addition, it will use some of the same questions asked in the Arthur D. Little study (Little 1967). It is the intention at this time to ask some of the same questions that were asked at the time of the Little study.

Work Unit Products

This work unit will produce a series of products targeted for Division, District, and Project managers. Information gained from this study will be included in a handbook on fees as a management tool, one or more technical reports, and at meetings and conferences, including the Natural Resource Management Conference in 1993. The legislative history and bibliography will be most useful to HQUSACE.

It is intended that the information gathered from this task will be used in several ways. Study findings can be presented at District and Division meetings of managers and rangers to improve their understanding of how their perceptions on this issue affect their management style and utilization of fees as a management tool. Case studies of successful use of fees as a management tool will be included in the report and also in publications such as *RECNOTES*.

A *RECNOTES* article on the history of Corps fee legislation will be prepared from the information contained in the Plan of Study. The fee bibliography and *RECNOTES* article will be submitted for technical review in mid-April 1992.

The willingness-to-pay study will be submitted for technical review at the end of April 1992. A more in-depth legislative history will be submitted for technical review at the end of October 1992 for possible publication as a technical report.

Additional reports will be prepared for each of the three components of the attitudes, motivations, and perceptions section. These will be submitted as indicated on the milestones section of the work unit documentation. Some of the material will be used to write journal articles. A final technical report synthesizing major findings will be prepared and submitted for technical review, as indicated in the work unit documentation.

References

Little (Arthur D.), Inc. 1967. Marketing study and recommendations concerning Federal recreation area permit and fee system—Report to Bureau of Outdoor Recreation. Washington, DC.

U.S. Army Corps of Engineers. 1990. U.S. Army Corps of Engineers recreation study. Headquarters, USACE, Washington, DC.

Development of Improved Methods of Identifying Camping Trends at Corps of Engineers Projects

by
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Introduction

Since 1980, camping trends have been monitored at Corps of Engineers (CE) projects in the Research and Demonstration System (RDS). The purpose of the work unit "Evaluation of Camping Trends at CE Projects" is twofold. The first objective is to track key variables associated with fee campers at a national sample of CE projects. The second objective is to provide data for related work units requiring information on the characteristics of fee campers.

The RDS is composed of 24 operating water resource development projects and is designed to provide study sites for many Natural Resources Research Program (NRRP) work units (Hart 1981). Sixteen of the 24 RDS projects contain fee campgrounds and have participated in monitoring camping trends. The thrust of this project has been to develop efficient methods of monitoring trends that take advantage of advances in technology and meet the needs of managers and planners. This process has resulted in innovations in the acquisition and processing of trend information at CE projects.

Purpose

The purpose of this paper is to describe the current method of monitoring camping trends at RDS projects and to present an improved approach for monitoring trends at CE projects.

Current Approach

Trend data are currently collected in two ways at participating projects. Projects using the Automated Use Permit System (AUPS) collect trend information directly on microcomputer through the use of AUPS. Projects not participating in the AUPS program collect trend information on paper camping permits. Data from the permits are then keypunched by District offices and transmitted to WES. Trend information is then compiled by WES and distributed in annual reports.

The adoption of AUPS at many projects has greatly improved the efficiency of this process by eliminating data keypunching and improving the quality of information through direct entry to microcomputers. Some projects not participating in the AUPS program have discontinued their participation because of the data processing costs.

Future Approach

The widespread use of AUPS at CE fee campgrounds and recent developments in commercial database report generation software have created an opportunity to reformulate the approach used to monitor camping trends and overcome limitations of the current approach.

In FY93, WES will develop one or more standardized reporting programs that will allow the production of summary reports at the project level. The microcomputer program(s) will be designed to use AUPS-generated data to generate summary reports that, when produced over time, can be used to monitor trends. The summary reports will initially include the basic information included in the WES camping trend reports. An example of the kind of information to be included in the basic program is presented as Figure 1.

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

Table 1
Lake Barkley 1990 CRS Data

	Boyds Landing	Bumpus Mills	Canal	Devels Elbow	Eureka	Hurricane Creek	Total
Summary Statistic							
Total Permits[1]	197	381	2,768	363	276	1,017	5,002
Total groups[1]	182	361	2,591	327	276	989	4,726
Recreation Days[1,2]	1,595	2,516	26,104	1,586	2,384	8,411	42,596
Nights Spent	2.8	2.5	3.7	1.8	2.7	3.1	3.3
Party Size	3.1	2.7	2.7	2.8	3.3	2.8	2.8
Occupancy Rate:[3]							
Total	29.6	19.0	62.6	22.7	27.4	38.0	33.2
Weekend	38.1	26.8	75.1	37.8	37.2	47.8	43.8
Weekdays	26.0	15.6	57.4	16.4	23.4	33.9	28.8
Total Fees[1]	$1,038	$1,409	$13,520	$886	$1,298	$5,272	$23,421
Average Fee Paid per Site[4]	$74	$43	$159	$47	$62	$103	$81
User Characteristics							
Prior Visits	92.9	68.4	45.7	84.7	84.8	14.8	47.7
Primary Destination	97.3	99.7	44.7	89.9	97.5	17.6	51.4
Golden Age	20.3	15.5	41.3	18.0	38.0	26.4	33.6
Golden Access	5.5	4.2	8.2	2.4	0.7	9.1	7.1
Vehicle Equipment							
Car	33.5	28.3	18.1	23.2	51.4	3.4	18.7
Truck	52.7	53.2	28.8	56.0	59.1	9.4	31.1
Van	22.5	6.6	6.8	10.4	12.7	3.3	7.3
Motor Home	6.6	17.5	15.5	5.5	8.0	6.4	12.3
Camping Equipment							
Tent	48.9	38.0	7.8	57.5	44.9	2.6	16.2
Pop-up Trailer	8.8	8.9	3.4	4.3	11.2	1.1	4.1
Pickup Camper	13.7	9.1	3.0	6.4	12.3	2.3	4.5
Travel Trailer	14.8	15.2	22.8	8.0	27.2	4.7	17.4
Recreational Equipment							
Powerboat	34.1	48.2	11.8	55.0	53.3	12.6	21.1
Sailboat	0.0	0.0	0.3	0.6	12.0	0.0	0.9

[1] These totals are reported as sums (all others are the percent of all users).
[2] Recreation area averages were weighted by the total number of permits for each area to compute project averages. The total was a sum.
[3] Occupancy Rate is calculated by the number of nights paid divided by (the number of calendar nights multiplied by the number of sites at each campground).
[4] Average fee paid per site was the total fee collected at each area divided by the number of sites at that area.

Figure 1. Sample data summary for recreation project area

Recent trend reports have expanded the types of information routinely monitored (DeMoss 1991).

All projects participating in AUPS will have the option of using the reporting program(s). Participation in the reporting system will not be mandatory. Future development of additional standardized reports for use in conjunction with AUPS will be planned in out-years. Input from field personnel will be sought to identify information needs that could be addressed by this reporting system.

This approach will improve the efficiency of developing trend information on camping at CE projects. The development of national camping trend information by WES on an annual basis will be discontinued. However, WES will be available to monitor national camping trends when requested by Headquarters, USACE.

Benefits of Future Approach

The future approach for monitoring camping trends using AUPS data has a variety of benefits over the current approach.

a. More projects will be included in the system. The current system monitors trends at fewer than 10 projects. The future approach will be immediately available to over 100 CE projects. Additional projects will have access to the monitoring system as AUPS is adopted at other projects.

b. Access to the system at the project level will allow for quicker turnaround of trend information.

c. Direct access of the system at the project level will allow the information generated from the system to be more effectively incorporated into local management activities.

d. Retention of AUPS data at the project level will still allow national trends to be monitored as needed and provide information for use on related NRRP work units.

Conclusions

The NRRP work unit entitled "Evaluation of Camping Trends at CE Projects" has evolved over the years to meet the changing needs of the Corps and to take advantage of opportunities created by new technologies. The development of analytical tools that can be made available to CE staff at the project level creates opportunities to provide information to allow CE projects to continue to respond to the changing needs of the visiting public.

References

DeMoss, Tere A. 1991. Recent developments in Campground Receipt Study data collection. *RECNOTES*. Vol R-91-3. U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Hart, William J. 1981. Recreation Research and Demonstration System: Its selection, operation and potential utility. Technical Report R-81-1. U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Regional Recreation Demand Model

by
Jim E. Henderson[1]

Introduction

The objective of the Regional Recreation Demand Models (RRDM) Work Unit is to develop models that predict recreation use and benefits. Recreation use and benefits models will be developed that incorporate all the projects in a region, rather than being only a visitation and benefit model for a single project. RRDM predict visitation based on variations in resource characteristics and the availability of substitutes. It is assumed that visitor decisions about recreation are based on the natural resources of projects and the available facilities and other recreation resources. Decisions on where to recreate (that is, to choose to go to one project rather than another) consider the availability and desirability of substitute projects.

How Do Regional Recreation Demand Models Work?

Regional models predict visitation by allocating recreation use to the projects in a region based on the natural resources, recreation resources, and user characteristics. The power of the regional models for making decisions on operations or for planning comes from the incorporation of the substitutes. RRDM will have the ability to answer "What if" questions about such changes as water level changes, closings, rehabilitation of facilities, or initiation of fees for day use or an increase in camping fees. The model will determine how visitation at the projects will respond to each change and how visitation will be reallocated in the region.

Travel cost regional models

The Corps' RRDM will be developed as travel cost regional models. Travel cost benefit models utilize the distance to the visitor's origin as indication of the demand of the visitor for recreation at a project and his willingness-to-pay for using the project. The origin (i.e., zip code) data, collected with Corps recreation use surveys, are providing the basis for the RRDM.

Although called travel cost models, the models also incorporate other predictors of recreation use in the calculations. The models will predict visitation to the project (dependent variable) as a function of the natural resources, facilities, and user characteristics of the visitors (independent variables).

Data for the models

Data required for modeling regional demand consist of project visitation, natural resource, and facility data; information on the substitute projects; recreation quality information; and demographic information about project users. The most important data required for the RRDM are the visitation survey data, which contain the origin and recreation activity data. Information about the facilities and natural resources of Corps projects is incorporated in the Natural Resources Management System (NRMS) and other Corps data systems. Information on the substitute projects will be obtained from the agencies that manage the projects. Other agencies, such as the state fishery and wildlife agencies, will be the sources of information on fishing quality, water quality conditions, and other variables that may be important to the quality of a recreation experience, but which the Corps does not monitor or keep detailed records for. The demographic data for user characteristics information will likely come from census data.

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

Work Unit Status

During fiscal year (FY) 1991, an Interagency Agreement was initiated with the Cooperative State Research Service, U.S. Department of Agriculture, to work on the modeling effort. Under this agreement, three university resource economists have been assigned, through their respective agricultural experiment stations, to work on the RRDM. After the Interagency Agreement was in place last year, criteria were developed to identify the regions to be used for development of the regional models. These criteria were

- Availability of data, specifically the traffic-stop recreation use survey data.
- Variation in recreation resources. The models needed to be developed to accommodate the differences in recreation resources, from the standpoints of geography and variation in natural resources of the projects managed by the Corps.
- Ability to generalize to other regions.
- Corps as the primary provider of recreation.

The last of the criteria was specified so that, for the regions selected, it is assured that important data would be available through NRMS and other Corps data sources. Since much data on the natural resources and the substitute projects will have to come from other sources, it was judged that by using regions where the Corps is a major recreation provider, we are certain of the credibility of the data.

Based on these criteria, the three Districts selected are Little Rock (Arkansas and White Rivers projects), Sacramento (Central Valley projects), and Nashville (Cumberland River projects). This diversity of projects will help ensure that, once developed, the models can be generalized or adapted to a larger number of other similar regions.

One comment that should be noted relating to the criteria—much has changed in the Corps about the manner in which we collect and process the data since the recreation use surveys were initiated in the mid-1980s. The establishment of Corps Information Management Offices (IMO) and turnover in District personnel has resulted in a situation whereby the survey data collected and stored in District IMO may or may not still exist, or personnel may not be able to identify the data. It is recommended that Districts that have performed the recreation use surveys pursue finding out where the data now reside and make efforts to secure them within Natural Resources control.

Model Development

Model development for the three regions was initiated in fall 1991, and the three models are scheduled to be completed by summer 1993. Developing the models involves determining how strongly project characteristics and user characteristics are related to actual visitation. In other words, variables will be tested to see whether the variables are good predictors of visitation. It may be that the important variables for one region are only weakly related, or of no relation, for predicting visitation in another region. An initial list of project and user characteristics is given below.

Project Characteristics	User Characteristics
Surface acres	Age
Fishing quality	Income
Water quality	Travel time
Water elevation	Vehicle costs
Shoreline development	Travel costs
Fees or other costs	

The models will have two components: a day use model and a camping model. The survey data for the projects are not extensive enough to support a more detailed breakdown for modeling, and perhaps more importantly, the two components will support the majority of the decisions for which use and benefit estimates are needed.

Applications of the Models

After model development is complete in FY93, decisions will be made on how to apply the models. There are two categories of possible applications: changes in quantity of recreation resources, and changes in quality of the recreation experience. Changes in quantity of recreation resources include evaluating the need for new recreation resources through new construction, change in existing uses of facilities such as rehabilitation efforts, and the effect of closings on recreation use. While the Corps is not constructing many new projects, there are continued efforts in evaluating closings and determining regional needs and sitings for camping and day use facilities.

Use of the models to evaluate changes in recreation quality includes such applications as water reallocations, institution of fees, and changes in fishery conditions. These applications, more so than the quantity applications, rely on data above and beyond those normally documented. For instance, application to a water reallocation question would require that visitation estimates be available for periods of high- and low-water conditions.

The travel cost models can readily be used for evaluating fee applications. Since travel costs are used as a proxy for willingness-to-pay, a higher fee could be evaluated as a change (i.e., an increase) in distance of the point of origin.

Changes in the quality of a fishery result from changes in project operations, e.g. pool drawdowns, as well as fishery management efforts. Those fishery changes that are represented by variables in the model, e.g. water surface, can be used to evaluate fishery changes.

The importance of the quality of a project's fishery is evidenced by initiation of the Reservoir Fisheries Work Unit, although this work will not be completed in time for the RRDM. For the RRDM, existing data from the Districts and state or other fishery management agencies will be used. Variation in available fishery data for the projects will result in different approaches to addressing fishery changes.

Applications of the models will begin in summer or fall 1993, after completion of model development and following whatever review and refinements are necessary.

Products of the Work Unit

A number of products will be produced by this work unit. In addition to the models and applications, an Instruction Report or User's Manual will be produced. The User's Manual will document the development of the model, explaining model development and providing guidance for another District to develop a model. The models can be applied in regions other than where developed, following the process set out in the User's Manual.

Summary

The RRDM will assist Corps planners and operations personnel in making decisions regarding proposed changes. "What if" questions regarding the effects on recreation and recreation benefits can be answered in a quantitative, documented manner. In this way, the impact to recreation of agency actions can be accounted for in terms of numbers of visitors affected and changes in economic benefits. Recreation will then be better able to be adequately considered along with navigation, flood control, and other project purposes.

Year 2: Management of Water-Based Recreation Opportunities

by
John Titre[1]

Dimensions of the Problem at Corps of Engineers (CE) Projects

Water-based recreation

Findings from the technical requests suggest that the scope of the problem was broader than regulating people boating on a lake. For most lakes, lake management is a state responsibility that is done to enforce safety and fish and game regulations. On the other hand, access is under CE authority to ensure protection and preservation of the desirable environmental characteristics of the shoreline consistent with the project's authorized purposes. This authority is found in Engineer Regulation 1130-2-406, Lakeshore Management at Civil Works Projects, 13 December 1974.

The problem of overuse can be viewed in the context of the situation where greater access has resulted in more boats and watercraft on the lake. Consequently, the problem is bigger than lake boating, to include the regulation and management of access.

Although this view expands the scope of the problem, it delimits the kinds of activities involved in the access/water use relationship. Water-based activities are dependent on the use of the water for engagement in recreation, e.g., boating, swimming, and fishing. In contrast, water-related activities are enhanced by their association with water, but could take place in the absence of a water body, e.g., upland game hunting, camping, and picnicking. Consequently, the scope of this work unit is limited to the management of water-based activities.

Increased use and diversity of activities

Most projects have reported an increase in the amount of use. The increased use is associated with national trends, which indicate an increase in shorter trips closer to home. More use puts a greater strain on facilities and staff. Fortunately, water-based recreation use tends to be concentrated in time and place under somewhat predictable conditions.

In addition to the amount of use, diverse types of use add complexity. Single and tandem jet skis are a good example of how new technology is defining the manner in which people use CE projects. Even water-skiing has a great diversity of watercraft, with each skier requiring a moving "bubble of territory" that exerts influence on other activities. For example, the author responded to a technical request at Falls Lake, North Carolina, where many near-misses of boaters were occurring.

User demand for higher quality

Visitors expect higher quality facilities and a return on their personal investment in outdoor recreation activities. Responses to several open-ended questionnaires indicate greater expectations for management to give visitors what they are looking for. Increases in fees for camping have contributed to visitors demanding more for the dollars spent. Even visitors to areas with no fees or low cost remark about the length of the grass, cleanliness of the restrooms, and "people problems" where management is required.

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

The perception of diminished quality continues to surface as a problem for management as return visitors complain of crowded conditions at boat ramps and out on the lake. Demands for higher quality increase pressure on managers to provide answers about how the lake is being managed to meet customer needs.

User conflicts

Conflicts among water-based recreation uses are inevitable. A technical request for Falls Lake revealed that watercraft with less ability to maneuver tend to be dominated by groups with greater ability. As an example of this incompatibility, bass fishermen have complained about powerboats in finger channels. Watching sailboarders attempt to outmaneuver jet-ski users is a good example of recreation conflict. Sailboarders have a low tolerance for jet-ski users (Titre 1984). This supports wilderness research findings that document differences between motorized and nonmotorized canoeists (Lucas 1964). The problem of incompatible use will tend to worsen with increased use and increased diversity of user groups.

Management objectives

With increased use, diverse activities, and incompatible uses, managers face the dilemma of trying to manage for competing interests. The challenge is to effectively manage the lake to accommodate conflicting uses without using labor-intensive law-enforcement techniques. Any active manipulation of management tools such as zoning or education should be an outgrowth of quantifiable objectives about the type of experiences a lake can provide. Although objectives are found in Operational Management Plans, they tend to be general (Titre, Peyman-Dove, and Waring 1989) and not useful for carrying capacity determinations. Instead, operational objectives should have the following five characteristics (Shomaker 1984):

a. Specific.

b. Output oriented.

c. Quantifiable.

d. Time bound.

e. Attainable.

Accidents, health, and safety

Crowding can lead to accidents and can result in unhealthy lake conditions. Research can recommend management actions to provide for conditions under which safe levels of use will occur. For example, education is one management tool that may reduce accidents. However, recreation use and accidents are subject to a number of influences that may be outside management control. Health issues may be of concern where water quality standards fall below accepted levels and the problem can be attributed to recreation. Health and safety parameters may be useful in carrying capacity determinations.

Resource impacts

Overuse problems such as parking on the grass near boat-launching facilities is enforced under Title 36. Therefore, it is difficult to separate water-based activities from their effects on land use. Soil compaction near boat ramps has forced some managers to rehabilitate areas in deteriorated condition. Other resource impacts associated with the water, such as litter and dumping, are measurable.

Ignoring resource impacts in a study of overuse would be inadvisable. The decision-making framework should include inventory procedures that carefully document where these impacts are occurring and recommend strategies to alleviate the effects of overuse as they relate to water-based activities.

Non-Federal facility expansion and development

Facility expansion typically involves a request by a private entrepreneur to enlarge existing structures or to provide new water-based facilities at undeveloped locations. Studies are conducted to determine the carrying capacity of the resource. A task force may be assembled with specialists from Real Estate, Planning, Recreation Resources, Architectural, Civil, Cultural, and lake management personnel. This task force evaluates long-term impacts on the resource, site-capacities, and development regulations.

After development recommendations are made, project personnel then deal with the operational issues of how to accommodate any proposed changes.

District personnel, when deliberating on facility expansion, usually lack information in several areas. First, District specialists (especially in recreation) often lack defensible criteria on what constitutes carrying capacity. Unless lake personnel have been gathering information over a period of time on actual use distributions, secondary data derived from demand analysis alone (from State Comprehensive Outdoor Recreation Plans) often lack the specificity to support a decision. Second, once a decision is reached, project personnel must deal with how the proposed change is going to affect existing uses. Therefore, the need exists for an ongoing information mechanism that will satisfy District requests while answering the day-to-day issues related to changes in the amount and type of use.

A commitment to institute a process to gather strategic information can assist all team members with the **project-specific** data they need and reduce the personnel burden and expense of new data collection efforts for each proposed development. Such a framework would be a cost-efficient and effective way to support facility expansion decisions and monitor the effect of these decisions.

Carrying capacity concept

Increases in the recreational use of non-CE public lands in the 1950s and 1960s led to the establishment of use limits in some areas. The concept of carrying capacity was borrowed from range and wildlife management, where it was used to estimate the number of animals of a particular species that could live on an area without doing long-term damage. Recreation managers hoped to establish carrying capacities for human use. However, there are several important differences.

First, site development ("hardening") of recreation sites changed capacities beyond natural conditions, allowing for additional capacity. Second, each user type and subtype has different expectations for their recreation opportunity and makes different demands on the resource. Consequently, the diversity of subtypes within major user types (such as crappie fishermen or parasail water-skiers) made aggregate calculations unrealistic.

Washburne (1982) proposed a major change in thinking about recreational carrying capacity. He had been involved in an extensive survey of U.S. Forest Service (USFS) areas where different management strategies were tested, and suggested that it may be more useful to examine large management areas and identify diverse conditions existing in various parts of the areas. These areas could then be zoned for particular types of recreation opportunities, and management actions necessary to maintain appropriate conditions (including limitations of use) could be determined. This approach recognized the inherent diversity of recreation areas and visitors, rather than trying to apply an equation to limit use.

Washburne's ideas related closely to concepts proposed by Wagar in 1966. He suggested that diversity in outdoor recreation was very important. He stated:

> The important thing is not to expect everyone to want the same type of recreation opportunity. By providing a variety of opportunities, zoning (developing management prescriptions by zones), and interpreting those attractions, we should be able to provide benefits from recreation from now on.

Implementing these concepts meant that more was involved than simple calculation. Carrying capacity processes were developed that organized the data collected and analyzed into several steps. These processes include Limits of Acceptable Change (LAC), Carrying Capacity Assessment Process (C-CAP), Visitor Impact Management (VIM), and Quality Upgrading and Learning (QUAL).

LAC and C-CAP. These processes were designed for the USFS for the conditions of low visitor density in remote western areas of the United States. The systems measure encounters between users on trails and rivers. The numbers of encounters are used to prescribe zones of contact within a spectrum of management units.

Corps lakes have high-density situations, and these systems have not been validated in such situations. A complete evaluation of each decision process was completed during April 1992.

Visitor Impact Management. This process has much in common with LAC, as it focuses on limits derived from "impact indicators" or "standards of acceptable change." The difficult task is identifying and measuring these indicators. In relation to water-based recreation, "boats-at-one-time" has been suggested by one researcher as a potential indicator for health and safety thresholds (Frye 1986). Frye used a "limiting factor approach" to derive a number related to lake zones. The strength of the "acceptable change" approach is that it provides scientific evidence on the relationship between use and impact.

Another advantage of VIM is the measurement of satisfaction indicators to produce an index of quality. A disadvantage of VIM is that it requires managers in the second step to provide a "clear statement of specific area objectives." Experiences in responding to technical requests on carrying capacity indicate that, before managers decide on what kinds of opportunities they want to provide (objective setting), they need to understand what they are currently providing.

Quality Upgrading and Learning. All models share common ground in terms of the items in each step. The major advantage of QUAL is its emphasis on inventorying existing conditions prior to objective setting (Hammitt and Cole 1987):

> Reliable data are needed to manage recreation just as reliable inventory data are needed to manage other natural resources, such as timber. Unfortunately, they are seldom available. In recreation, management has too frequently had to rely on guesswork or the personal experience and intuition of managers. While a manager's professional opinion is important, it is no substitute for reliable and systematically collected inventory and monitoring data. This is particularly true when turnover in personnel is frequent, as in government agencies.

Part of the inventory is done with a short set of questions that ask visitors about their perceptions of "quality" conditions in the area. Questions are deliberately kept short for easy administration and tabulation. This also facilitates repeat use in monitoring for management area changes.

Comparison of QUAL and VIM

QUAL and VIM have been used and tested over the past 5 years. Both are useful for project and District needs by providing a framework for organizing, quantifying, and communicating the complex aspects (physical-biological, social, managerial) of recreation management areas. These processes provide a structured approach to problem-solving and communication. Probably the biggest asset of QUAL and VIM is a mindset change for managers—from preoccupation with individual "problems" and crisis management toward focusing on the **process** that will provide information to answer questions and address the challenge of "improving recreation quality." Before field testing, both systems are being pilot tested at sites that represent varying problems and conditions.

Pilot Testing and Model Development

Pilot testing of VIM and QUAL is being conducted at two CE projects—Berlin Lake and Youghiogheny River Lake, Pittsburgh District. Initially, Alum Creek Lake, Huntington District, was selected; however, it had to be dropped because of low water levels.

The purpose of pilot testing is to adapt QUAL and VIM procedures to meet Corps conditions. Those applying the procedures will work with respective project and District personnel to test their respective models. After the first-year initial test, the effectiveness of each procedure will be evaluated by personnel of the U.S. Army Engineer Waterways Experiment Station (WES). Based on the findings, a determination will be made of which procedure or combination of procedures is to be used in future field studies.

QUAL will be pilot tested at Youghiogheny River Lake by an experienced QUAL user under the guidance of the system's developer, Dr. Kenneth C. Chilman, Southern Illinois University. He will work closely with project management to follow the procedures of identification and inventory of management units as conducted for the Turkey Bay area of Land Between the Lakes (Chilman, Vogel, and Conley 1991). The principal investigator (from WES) will periodically visit with project and District staff to evaluate progress. A report will be provided to WES that includes summer data and describes how QUAL was modified for application to a CE project.

VIM will be pilot tested at Berlin Lake by the system's developer, Dr. Alan Graefe, Pennsylvania State University. The pilot test will be closely coordinated with project management to follow procedures conducted for various recreation settings (Graefe, Kruss, and Vaske 1990). The principal investigator will periodically visit with project and District staff to evaluate progress. A report will be provided by Dr. Graefe that includes summer data and describes how VIM was modified for application to a CE project.

References

Chilman, Kenneth C., Vogel, James J., and Conley, Jerry L. 1991. Turkey Bay off-road vehicle area at Land Between the Lakes: Monitoring use and impacts since 1973. Motorcycle Industry Council, Land Between the Lakes Association, Land Between the Lakes, Tennessee Valley Authority, Department of Forestry, Southern Illinois University.

Frye, Debra. 1986. Lake Powell: A method for optimizing recreation opportunities for flatwater recreation. Master's thesis. Oregon State University.

Graefe, Alan R., Kruss, Fred R., and Vaske, Jerry. 1990. Visitor impact management: The planning framework. National Parks and Conservation Association.

Hammitt, William E., and Cole, David. 1987. *Wildland recreation: Ecology and management*. Wiley and Sons, New York.

Lucas, R. C. 1964. The recreational capacity of the Quetico-Superior area. Resource Paper LS-15. U.S. Department of Agriculture Forest Service, Lake States Forest Experiment Station, St. Paul, MN.

Shomaker, J. H. 1984. Writing quantifiable river recreation management objectives. *Proceedings, 1984 national river recreation symposium*, Baton Rouge, LA.

Titre, J. 1984. Recreation specialization and conflict in board sailing. Paper presented at National Recreation and Park Association Research Symposium, Orlando, FL.

Titre, J. P., Jr., Peyman-Dove, L., and Waring, M. R. 1989. *Proceedings: Workshop on operational management plans, Improving the process*. Technical Report EL-91-4. U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Wagar, J. Alan. 1966. Quality in outdoor recreation. *Trends in Parks and Recreation* 3(3):9-12.

Washburne, Randel F. 1982. Wilderness recreational carrying capacity: Are numbers necessary? *Journal of Forestry* 80 (Nov):726-728.

Summary—Breakout Session, Field Review Group and District Points of Contact

by
Frank Star[1]

The session was moderated by Dave Wahus (Headquarters, CECW-ON) and recorded by Frank Star (St. Paul District, CENCS-CO-NR). WES staff was not present during the session.

Briefly, the agenda for the session was as follows: review the comments/concerns from the past two breakout sessions, discuss current concerns, and discuss proposed work units.

Current Concerns

The proposed work unit that was ranked highest by the Field Review Group last year (Measuring Economic Impacts of Dispersed Recreation) was not discussed at this meeting, and there is no indication that it will begin next fiscal year. It was noted that the proposed work unit would be delayed until after completion of the dispersed use estimation work unit (scheduled for completion this fiscal year). [***Note:*** *In a later session it was noted that, although the methodology for measuring dispersed visitation will be completed at the end of FY92, it will not be published until FY93. The methodology then has to be applied. After Districts have collected dispersed visitation data, economic impact methodology can be applied to determine impacts.*]

The direction of the work unit on fees (32745 - Measuring the Effects of Recreation Fee Programs) apparently has changed from what was described and voted on last year. Several comments were made indicating that the general direction of the work unit should be changed back. The problem of the work unit's changing direction/focus during the course of study has been expressed in the past. It was noted that this is another example of that problem. [***Note:*** *In a subsequent session, it was noted that Headquarters, USACE, recommended the work unit's change in direction. There was some discussion during that session of formalizing a procedure to inform the Field Review Group of such changes.*]

The Economic Impact of Recreation work unit was completed this year. Participants at this meeting expected feedback as to what was accomplished, etc. Photocopies of two draft reports prepared under this work unit were available for review; however, no other information was readily available. The work unit seems to have faded away. There was general disappointment and frustration expressed by the lack of follow-up at this meeting. The group, at least, would have liked to have recognized the completion of the work unit.

A proposal was made at last year's meeting to develop regional load factors. The question was raised as to the status of this effort. It was reported there was a Natural Resources Technical Support (NRTS) effort ongoing to study the feasibility of regional load factors.

Significant concern was expressed regarding the list of proposed new starts (too short, too limited, etc.). The subsequent discussion raised a number of issues relating to how work units are proposed, which need to be addressed.

- Considerable discussion focused on the process for submitting ideas for new work units.
  - — The suggestion was made that a schedule be established and the various due dates published annually in *RECNOTES*.
  - — The idea of a submittal form, to be included in *RECNOTES*, was

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submitted at last year's meeting, and it was not implemented.

- — Generally, there has been little feedback on proposed work units submitted from the field. Meaningful feedback will promote more proposals being sent forward. Discussion was given to the way in which proposals could be submitted: they should be submitted directly to Judy Rice. A *RECNOTES* article will be published on this.
- — Questions were raised as to the format, if any, for proposals. There is no standard format—only minimum requirements.
- — The concept of a matrix for displaying proposed work units, their status, and the "why's" for the various decisions regarding the proposed work units was proposed. The matrix could be included in RECNOTES. It is believed that a display such as this could generate new ("better") ideas from the field.

- The scope of the Natural Resources Research Program (NRRP) is unclear. What are the limits to what can be investigated? Just operational projects?
- Should other labs be doing R&D for natural resources management, such as CERL did with the ERGO Program?
- The Peer Review process may be a way of identifying new work units.

There was a short discussion regarding the proposed Restoration of Sand/Gravel Mining and Gravel-Impacted Sites work unit. The question was raised as to whether this was in the right program; the Environmental Impact Research Program (EIRP) appears to be more appropriate.

There is a perceived problem with the Corps leadership fully understanding the economics and values associated with recreation at Corps projects. It has been expressed by the Corps leadership that recreation at our projects is primarily local in origin. We have data indicating that many projects are regional (multi-state) attractors. We have the research and data to support the magnitude of the impacts of our program. The question is: How do we get the information to the leadership in a format they will read and use? It was noted that this problem also exists at the field manager/ranger level. The important data, while in the various reports, are not always readily available; we need to develop summaries.

Related to the above concern was the question, Does the public have a perceived value associated with who manages a particular recreation area? Based on what we have heard, the public does view various managing entities and the resulting value of their areas differently. This may be a potential work unit describing how the public views our areas around the country.

Another concern that was discussed regarded trend information. We have access to good information on camping via the Automated Use Permit System (AUPS). However, we do not have comparable, readily accessible information on our day users. Because no fees are associated with the majority of Corps day use facilities, we have very little contact (transactions) with those users. Therefore, we do not know them as well. We would like to have comparable data for day users as we have for campers. Potentially, this could be a new work unit.

There was some discussion on the cultural/ethnic needs/differences issue. We recognize this as an important topic. Potentially, there could be a new work unit that would consist of a literature search for available information.

The ongoing work unit, Effect of Reservoir Operations on Recreation Fisheries (32797), was discussed. There were two major areas of concern. First, support (although not a consensus) was expressed for including tailwater areas as part of the study. Ongoing problems are being experienced with dissolved oxygen in the tailwaters at some projects around the country. [***Note:*** *it was reported at a subsequent session that there was a work unit in a different research program that was addressing this issue. It was noted that our group should be provided information regarding other related research programs to avoid these issues.*]

The second area of concern was that one of the research work units was deliberately excluding a geographical area/unit—coldwater fisheries, both streams and reservoirs. While the need to place a manageable limit on the work unit was recognized, concern was noted with regard to the precedent set. There was support for a similar work unit that addresses the needs of the coldwater fisheries.

The group wants the work unit documentation and the results of the voting to be included in the published proceedings.

A "Do Not Fund" category should added to the ballot. Currently, the ballot has "Low," "Medium," and "High" categories for funding.

It was pointed out that if FY93 funding remains at the $600K level, funds would not be available for new starts. Either the program would have to be allocated additional funds, or the ongoing work units and new starts would have to be prioritized.

The Field Review Group requested that summaries be published of completed NRTS requests and reimbursable work. These summaries should include the location of the project and a contact person.

We discussed possible ways for summaries of the research efforts to be disseminated. There is some question as to whether we are doing this properly/effectively. Should Headquarters, USACE, be more active in this area, especially with the economic impacts work?

A suggested possibility for facilitating technology transfer is through the use of video tapes—putting faces with the research and results. This may be a cost-effective means of disseminating information on the status of work units.

Discussion of Proposed Work Units

Resolving Wildlife-Human Conflicts at USACE Operational Projects (375-1)

This work unit has the potential for interagency cooperation and partnering opportunities, and will address safety concerns.

Among the questions raised were *Has this type of effort already been undertaken by others?* and *Who has the responsibility to control wildlife—the Corps or the local wildlife agency?*

It was noted that different species cause different problems, and the solutions may be unique in each situation. There was general agreement that the topic may be too broad and it should be narrowed. It was suggested that only the first phase of the work unit (literature search) be accomplished, focusing on the known problem species. The work unit then could be reevaluated. One possibility could be NRTS projects at individual projects addressing specific problems. The NRTS reports could be compiled and distributed for future reference.

The question of human-related conflicts on endangered species was raised to determine if this would be part of this proposed work unit. It mostly likely would not be part of the effort.

Restoration of Sand/Gravel Mining and Gravel-Impacted Sites (375-2)

This work unit is based on a request for assistance from the New Orleans District. The group believes that this may be better addressed as an EIRP project. Again, the question was raised if this proposal should be in NRRP. It was noted that a significant body of work already exists on this topic. The only research effort, if any, the group could identify was a literature search.

Development of a Corps-Wide Wildlife and Habitat Resource Database (375-3)

It was pointed out that this work unit was a revised version of one proposed last year. Other agencies are interested in the outputs of the proposed work unit.

One concern regards the inventories: funding for inventories at the project level would be at Level 3, so why conduct research that could not be applied?

Another concern regarded the need for another national database, considering the long-term costs. Also, not all projects need inventories at the same level of detail.

It was noted that if inventories are needed on a project, it is often easier and faster to contract the effort.

Interest in this proposed work unit was high. That interest raised a few questions, notably, the apparent lack of knowledge as to what inventory techniques are already available.

The question of acceptable methodologies was raised. If the Corps were to develop new methods, would they be accepted as valid by other State and Federal agencies? Also, measurements and reporting would need to be consistent throughout the Corps.

Evaluating the Use of Ground-Penetrating Radar to Locate Human Burials (375-4)

The group seriously questioned the need for this work unit. What is the research to be conducted? Does this work belong in NRRP or in another program? While the technique may be useful at some new construction sites, most operations sites have been disturbed.

There was some question whether, given the effective range of the equipment, it would be useful in some of our problem areas, such as eroded areas where there are very old burials, in karst limestone areas, and in heavily wooded areas.

This is a technology that was developed for other uses. The vendors of this technology may have already conducted research and developed the specifications we need to determine its usability.

Are there other types of radar (aircraft-based) that would be usable?

Measuring Economic Impacts of Dispersed Recreation - The Missing Work Unit (375-5)

The group believes this work unit is very valuable and wants it to be started next fiscal year. The data could be used in current legal cases.

One other potential new start would be the revisiting of a previous work unit on establishing vegetation in the drawdown zone of reservoirs. This is a new problem in the North Pacific Division, where the requirements for endangered species management call for significant drawdowns (30+ ft) over long periods of time (several months).

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