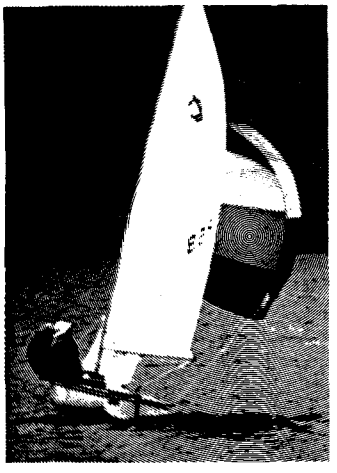
US Army Corps of Engineers
Waterways Experiment Station



ENVIRONMENTAL LABORATORY

RECNOTES
NATURAL RESOURCES RESEARCH PROGRAM

VOL R-84-5 INFORMATION EXCHANGE BULLETIN OCT 1984

How can this activity be measured for O&M efficiency? The following article describes guidelines for incorporating efficiency and effectiveness criteria into resource-allocation decisions.

MEASURING RECREATION AREA O&M EFFICIENCY AND EFFECTIVENESS

Larry Lawrence and John Titre
Environmental Resources Division, EL

When managers consider how to allocate their limited manpower and dollars, two questions logically arise: Is the manager budgeting resources in the most efficient manner? Does the budget meet the effectiveness goals of the Corps?

Efficiency examines the way in which resources are budgeted among alternative programs to satisfy user wants. It relates the benefits of a program to the costs of that program by comparing outputs measured in units of direct service or activities to inputs measured in dollars or employee hours expended. Ideally a manager's budget should allocate resources to achieve the lowest level of input cost for a given level of output.

Effectiveness relates outputs to program goals and infers the appropriateness of the outputs for meeting those goals. This article mainly addresses efficiency; Mills' article on performance analysis (Vol R-84-1) discussed measuring effectiveness from visitor satisfaction.

Program effectiveness and efficiency can be mutually exclusive. For example, efficiency in trash collection would be high if crews were allowed to spill garbage or skip campground loops that are hard to route. But if spilled garbage and missed campground loops do not meet program goals, then effectiveness is low. When either of the measures is taken to extreme, the result is probably a less productive program.

Based on research conducted by the Natural Resources Research Program, guidelines are being developed for incorporating efficiency and effectiveness criteria into resource-allocation decisions. These guidelines will suggest that recreation areas be classified according to levels of facility development so comparisons can be made between and among areas using a ratio that relates inputs to outputs. Following is a brief summary of the guidelines with a discussion of some potential applications.

EFFICIENCY

Efficiency Ratio

The input portion of the input/output ratio includes costs associated with the operation and maintenance (O&M) of the recreation area. A cost-tracking system (RECNOTES Vol R-80-1) is available for determining the cost (both in terms of manpower and dollars) of the in-house O&M of the project. The cost of performing any activities by contract should be added to in-house costs to generate a total O&M cost figure. Other costs associated with inputs are the planning, design, and construction of facilities. Historic data concerning recreation area development have often been included with other project costs and cannot be isolated. It is recommended that facility replacement cost be used for this portion of the total recreation area provision cost. The outputs measure is the total number of recreation days of use.

The efficiency ratio defines the cost of providing one recreation day of use in the recreation area where the data were gathered. Table 1 shows an example calculation of efficiency ratios for a 3-month period at a hypothetical recreation area. In the example, partially because of the constant monthly contract costs, the efficiency ratio varies inversely with visitation (the higher the ratio, the lower the efficiency).

Table 1 — Example Recreation Area Efficiency Ratio

	O&M Costs, $			*Visitation Recreation*	*Efficiency*
Month	*Contract*	*In-House*	*Total*	*Days*	*Ratio**
Jun	1312	2569	3881	5600	0.69
Jul	1312	1841	3153	8100	0.34
Aug	1312	1673	2985	6200	0.48

*Total O&M cost/recreation day served.

Applications

Comparison of efficiency ratios can be made among and between selected activities, areas, and projects. For the comparisons to be valid, it is very important to be consistent in defining the O&M activities and to be aware of any differences in the characteristics of the areas or projects compared.

Classifying areas according to level of development provides an indicator of the recreation opportunity provided visitors that is associated with facility development. As such, the procedure can be used to evaluate alternative management actions more meaningfully. In allocating limited O&M resources, managers must be concerned with the efficiency of alternative actions. Comparing such efficiency indicators as costs or man-hours expended per visitor are relatively meaningless unless consideration is also given to services and the level of performance provided.

Efficiency indicators for areas with the same development can be compared to determine the relative efficiency of areas with comparable facilities. The classification system can also be used to help analyze efficiency comparisons among areas with different levels of development.

The following tabulation is an example of efficiency ratios for selected recreation areas listed by class of development (class one to class six being the range from least to most developed). In the example, the average O&M costs per recreation day served were lowest (i.e., the most efficient) in Class 5 areas and highest (the least efficient) in Class 3 areas; a prudent manager would then investigate these anomalies.

Class of Development	*Efficiency Ratio*
1	0.21
2	0.28
3	0.45
4	0.25
5	0.15
6	0.38

Variations in efficiency within the same class could be investigated to determine whether or not the differences result from potentially correctable activities. To assist in this determination, an efficiency ratio can be developed for each function or activity performed (Table 2). In this example, the higher average efficiency ratio for Class 3 areas

Table 2 — Efficiency Ratios for Selected Functions by Class of Development

	Class of Development — Efficiency Ratio					
Functions	*1*	*2*	*3*	*4*	*5*	*6*
Resource Protection	0.01	—	0.07	0.01	0.03	0.06
User Protection	0.14	0.24	0.23	0.20	0.07	0.21
Supervisor	0.01	0.02	0.05	0.01	—	0.05
Visitors Information	0.02	—	0.02	0.01	—	0.03
Other	0.04	0.02	0.08	0.03	0.05	0.03
TOTAL	0.22	0.28	0.45	0.26	0.15	0.38

results primarily from having the highest or near highest individual efficiency ratios for all functions rather than for any particular function. The efficiency ratios will not tell the manager why the higher costs are being incurred, but they will highlight potential problem areas for further consideration.

A logical question that follows after identifying the functions that are most costly is how the manpower is distributed for accomplishing those functions. For example, Table 3 describes the level of responsibility of employees performing selected functions at a given recreation area. Data indicate that seasonal employees are performing the majority of the tasks in the categories of resource protection (80 percent) and maintenance for facility roads (72 percent). This table would be very useful for the manager who is concerned with which employees are performing specified tasks.

The use of efficiency ratios requires valid information on inputs (primarily O&M costs) and outputs (visitation). Valid visitation estimates can come from campground receipts (RECNOTES Vol R-82-1) and improved visitation surveys (RECNOTES Vol R-84-3). A workload/cost-tracking program can be used to record O&M cost data. The increased use of microcomputers at project offices makes the implementation of such programs practical. Once in place, the workload/cost-tracking system can provide information for a wide variety of management applications in addition to the efficiency analysis discussed above. These applications include:

- Monitoring status of scheduled O&M activities.
- Budgeting future work.
- Trend analysis of O&M costs.
- Documentation of in-house costs for contracting determinations.

EFFECTIVENESS

The relationship of inputs (costs) to outputs (visitation) provides a description of efficiency for a given area but should not be the single criterion for decisions concerning the allocation of resources. Consideration should also be given to the impact efficiency decisions will have on visitor satisfaction. One technique recommended for addressing user satisfaction is action grid analysis (RECNOTES Vol R-84-1). Action grid analysis can be used to determine visitor preference and their perception of agency performance in providing selected activities and services. These data then can be incorporated into managers' O&M resource allocation decisions.

SUMMARY

The guidelines described here should help the user determine if a resource allocation strategy is the most efficient and is meeting Corps effectiveness goals. If accomplished, we, in most cases, have a proper allocation of manpower and dollars and a satisfied visiting public.

Table 3 — Number of Man-hours by Level of Responsibility Devoted to Accomplishing Selected Functions During a 1-month Period

Level of Responsibility	*Number of Employees*	*Resource Protection*		*Maintenance of Facility/Roads*		*Equipment Operation*	
		Man-Hours	*Percent*	*Man-Hours*	*Percent*	*Man-Hours*	*Percent*
Seasonal (WG-5/6)	7	158.00	80.20	547.60	71.80	60.70	37.77
Permanent (WG-7/8)	4	31.00	15.74	142.50	18.69	70.00	43.56
Supervisor (WG-10)	2	8.00	4.06	72.50	9.51	30.00	18.67
TOTAL		197.00	100.00	762.60	100.00	160.70	100.00

How much water will be required to supply the water fountains, showers, and flush toilets at a recreation area? Reliable estimates of how much water recreation area visitors use are needed to design and operate the areas. The following article describes the results of a limited study of water use at two Corps campgrounds.

WATER USE AT TWO CORPS CAMPGROUNDS

John Titre and Michael R. Waring
Environmental Resources Division, EL

A pilot study was conducted during the summer of 1982 to determine the amount of water used at toilet/shower facilities by visitors at two Corps recreation areas. This study provided a very cursory examination of water use within the areas and was instigated as a result of comments from field personnel on the lack of such information specific to recreation areas. Estimates of how much water visitors use are important in determining the optimal design of facilities and services and also in assisting managers in evaluating the cost-effectiveness of different recreation areas based on water use per visitor day values.

Study sites for this project were Heber Springs and John F. Kennedy (JFK) recreation areas at Greers Ferry Lake, Arkansas. Facilities were selected that received predominately camper use, but both areas included some use by picnickers, swimmers, and boaters, due to their location near day-use activities. The facility selected at JFK was the only one with hot showers. At Heber Springs, the facility selected was the only flush-toilet service available.

Water meters and recorders were placed on one toilet/shower facility in each area. These meters recorded the flow of water in tenths of a gallon. Although the meters exhibited a tendency to malfunction when nearing the end of a recording period, a total of 82 days of good data were recorded at JFK, during which period 116,500 gallons of water were used; 56 days of good data were recorded at Heber Springs, during which period 39,040 gallons of water were used.

Figure 1 shows the distribution of the water use for each area over an average 24-hr period. As expected, peak use occurred during midmorning and evening hours.

Visitor-use data from campground registration records were then compared to the water-use

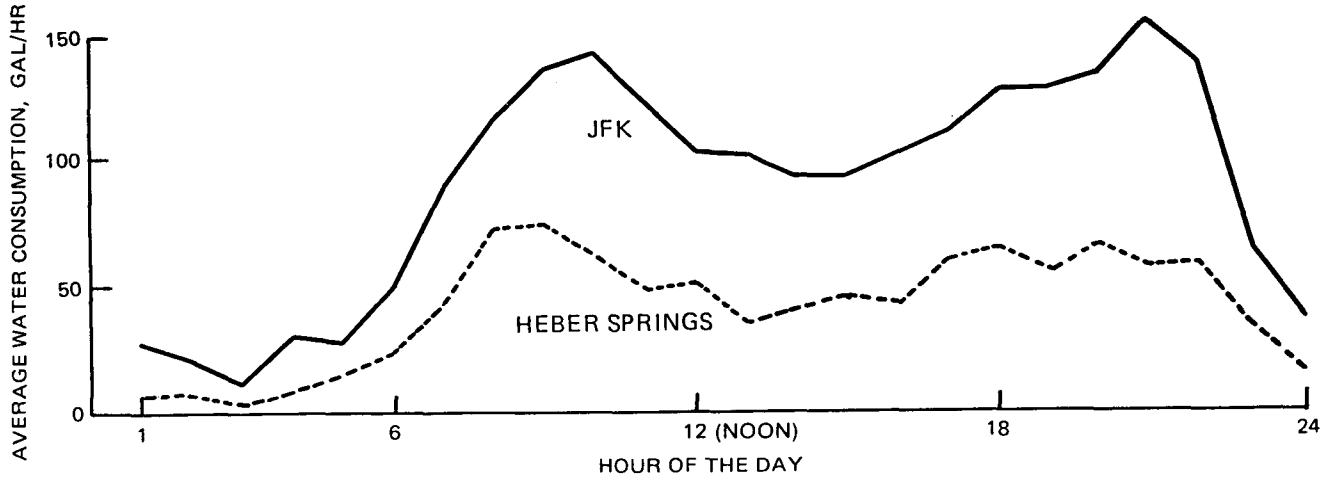


Figure 1. Average gallons of water used per hour at JFK and Heber Springs recreation areas

data. Gallons per user per day were calculated by dividing the average number of gallons used during the day by the average number of registered visitors in the campground. Gallons per user per day were higher at JFK recreation area than Heber Springs, and in both areas water usage was higher in June than either July or August (Figure 2). At JFK, this figure ranged from 13 to 19 gallons; whereas, at Heber Springs, it ranged from 5 to 7 gallons over the three summer months.

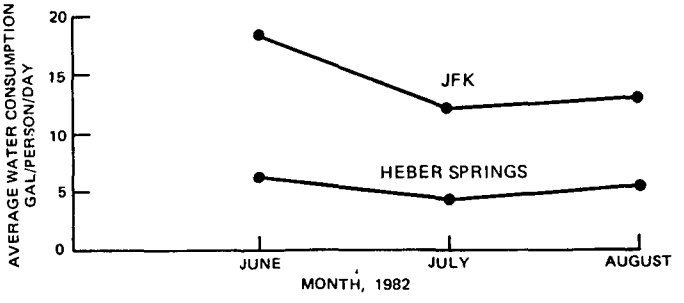


Figure 2. Average gallons of water used per person per day for the months of June, July, and August at JFK and Heber Springs recreation areas (based on total campers in the campgrounds)

Analysis of type of equipment and its relation to water usage resulted in several interesting relationships. For example, the higher the percentage of users with motorhomes, the lower the average water use per visitor. In contrast, when more pop-up trailers were present at JFK, average water use tended to be higher.

In evaluating the results of this study, it should be noted that at the JFK recreation area, some visitors from other areas may have used the facility since it was the only one on the project with hot showers. At Heber Springs, considerable numbers of nonregistered visitors (day users, other campers) may have also used the toilet/shower since it is the only water-flush facility available in the area. Therefore, using only the actual numbers of visitors from registration records may have resulted in overestimating the water use per visitor. For example, if records showed 100 registered visitors where water use was 1000 gallons at one facility, this implies that each visitor used approximately 10 gallons. If 100 nonregistered visitors also used that same facility and total gallons remained unchanged, it would mean that each visitor used approximately 5 gallons on the average. If this is the case, many Corps facilities may be over designed through the use of outdated water-use standards (generally 30 gallons per person per day EM 1110-2-401, Draft).

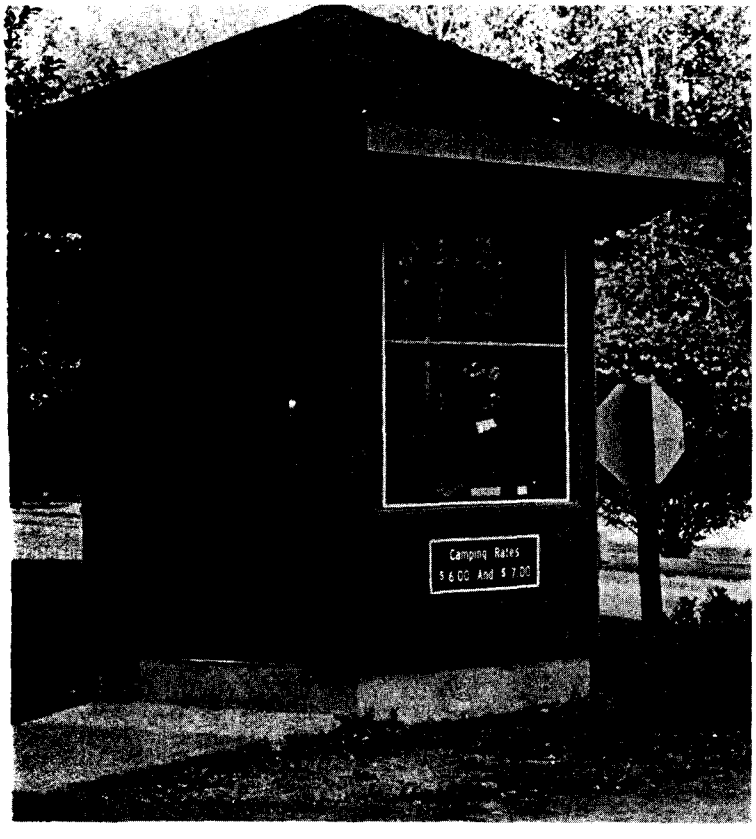
Findings in this study suggest that discrepancies may exist between actual water-use figures and standards found in Corps planning and design manuals. The relationship between water use and visitor use should be further tested at other recreation areas to improve planning and design criteria. Such a project might well be a study for master's degree requirements to which the NRRP could provide limited support. Any interested Corps employee can get additional information from Dr. A. J. Anderson (phone number 601-634-3657).

MOVABLE LANTERN HOLDERS

Are lantern burns scarring the trees in your campgrounds? The unsightly catface scars caused by lantern burns weaken the tree, provide entry places for insects and disease, and lessen the aesthetics of a wooded campsite.

Movable lantern holders are being used with success at campgrounds operated by the Nashville District on J. Percy Priest Lake and Old Hickory Lake. People generally don't hang lanterns on trees if a more convenient holder is available. The disadvantage of permanently fixed lantern holders is that a camper may want light in other places. The movable holder allows campers to place the lantern in the most convenient place.

The movable lantern holders are made with the manufactured lantern posts set in concrete inside an old tire. A board is placed under the tire to contain the concrete when it is poured into the tire. The finished product is a durable holder that can be rolled and put where the camper wants to use it. ***Carolyn Bauer, Natural Resource Management Branch, Nashville District, U.S. Army Corps of Engineers.***



VOCATIONAL SCHOOLS CAN HELP

Budget restraints and limited training funds often handicap the construction of needed new facilities and the development of additional job skills. Corps of Engineers Resource Managers on Lake Cumberland in Kentucky and Dale Hollow Lake in Tennessee have overcome this handicap by using the capabilities of state vocational schools.

The Clinton County Vocational School in Albany, Kentucky, built five Visitor Entrance Stations on Lake Cumberland that saved an estimated $1000 in labor costs for each station. The Corps supplied the plan and materials for construction of hexagonal booths that have five windows and one door. The unusual design of the structure presented a technical challenge that the school was happy to tackle.

The Vocational Technical School in Livingston, Tennessee, has rebuilt machines and automotive parts, constructed picnic tables, and trained Dale Hollow employees in the use of computers ... all at fractions of costs prevailing in the private sector. ***Jim Robbins, Park Ranger, Old Hickory Lake, Nashville District, U.S. Army Corps of Engineers.***

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An index of all articles appearing in RECNOTES since the first issue was printed in October 1977 is shown below. Please feel free to contact us if you need any back issues of RECNOTES.

We want to stress that RECNOTES is your information exchange bulletin and that we welcome any articles from the field. Give us a call if you are unsure of how to write your article (telephone 601-634-3657). Our objective is to make RECNOTES a two-way forum on Corps resources management and planning activities as well as to provide you with updates on NRRP activities. We need your support to meet this objective.

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MOWER WOUNDS KILL TREES AND SHRUBS

Power lawnmowers and "weed-eaters" have the potential to cause very serious injury to trees and shrubs growing in the landscape. This is especially true during the early spring and in early fall because the tree's bark is tender and more likely to "slip" during these times. If this slippage occurs, a large wound can be produced from even minor injuries. The site of injury is usually the root buttress; however, injury is also common almost anywhere on the trunk. Wounds caused by these pieces of equipment are serious enough by themselves, but the tree or shrub must also protect itself from pathogens that can invade the wound. These microorganisms will often attack the injured bark area and can subsequently invade the adjacent healthy tissues. Girdling from this microbial attack, and subsequent tree mortality, has been observed in numerous cases following mower damage.

This injury is not a tree problem or an equipment problem, it is a people problem. The solution is to educate lawn-mower and line-trimmer operators about the dangers of tree wounds and then to hold them responsible for any damage they cause. The land manager can also utilize some cultural techniques to cut down on these injuries, such as removing all turf around trees and replacing with mulch and by encouraging the use of hand trimmers. While the latter may seem labor intensive, in the long run it is more economical than replacing a specimen plant from in front of the Headquarters building or admiral's residence. Treatment of newly injured trees can be accomplished by bark reattachment with a few tacks or staples, if the wound is discovered within a few hours after injury occurs. If several days or weeks have passed since the injury, torn or loose bark should be cut away and the edges of the wound should be traced using a hand tool such as a pruning knife. Avoid making deep scribes or any vertical sharp points which can serve as additional sites for bark dieback and starting points for bark cracks. — Adapted from Weeds, Trees, and Turfs, 23(4) 84.

(Reprinted from the May 1984 issue of the technical information bulletin published by Defense Pest Management Information Analysis Center.)

The other side of the story...

DEPARTMENT OF THE ARMY
KANSAS CITY DISTRICT, CORPS OF ENGINEERS
700 FEDERAL BUILDING
KANSAS CITY, MISSOURI 64106

July 11, 1984

REPLY TO
ATTENTION OF:
Plans & Policies Section

Environmental Laboratory
ATTN: A. J. Anderson
U.S. Army Engineer Waterways Experiment Station
P.O. Box 631
Vicksburg, Mississippi 39180

Dear Andy,

I just received the May 1984 issue of RECNOTES. The article on page 4 regarding life-saving jugs caught my attention as we have just obtained a legal opinion regarding same (enclosure 1).

Our District has taken the position that we will not provide life-saving devices such as ring buoys, poles, or jugs at our beaches due to the potential litigation. You may wish to pass this on to the readers of future RECNOTES as a warning.

Sincerely,

Michael W. Carey

Enclosure

Michael W. Carey
Chief, Plans & Policies Section
Operations Division

A MODEL LAND-USE PLAN FOR FORT BENNING

Michael R. Waring
Environmental Resources Division, EL

A 3-year study of multiple-use natural resource planning for Fort Benning, Georgia, was initiated in September 1983. The purpose of the study is to develop a land-use plan for the installation and a planning methodology for the Training and Doctrine Command (TRADOC) for use at other military installations. The results of this study will also have applications to the Civil Works functions of the Corps.

Major study tasks include:

- Statutory and regulatory review.
- Review of mission land requirements.
- Natural resources inventory.
- Review of demand for alternative land uses.
- Determine management objectives.
- Determine land suitability.

Each task will use both existing data and data generated through field studies such as soil surveys, forest mapping and inventories, and habitat evaluation. All data will be digitized and analyzed on an Earth Resources Data Analysis System (ERDAS). This will allow rapid and extensive examinations of relationships among multiple layers of data (Figure 1). It will also allow for the development of an on-going resource management plan that will enable planners and managers (both training and resource) to make ***rapid*** and ***accurate*** assessments of proposed changes in land use. For example, if a certain area is being used to produce saw timber but it is proposed that the same area be used for a certain type of training, the proposed change can be quickly analyzed for both economic and environmental impacts. Also, alternative areas can be

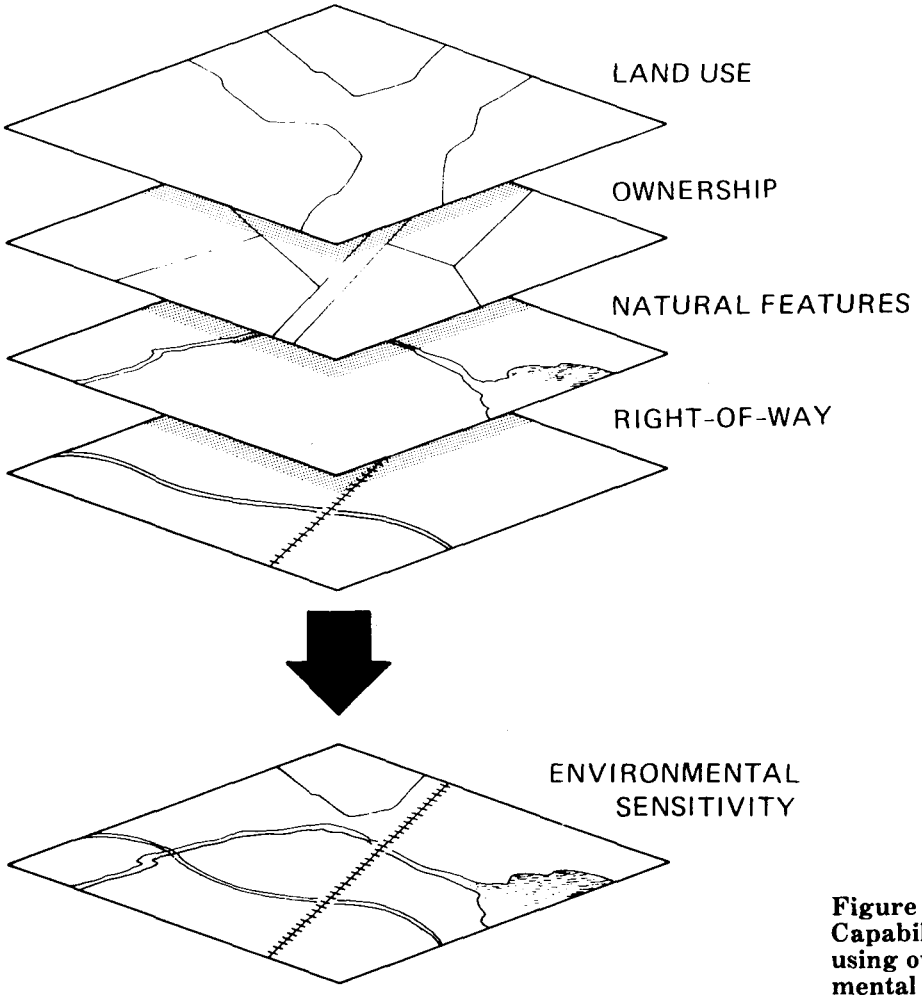

Figure 1. Geographic Information System Capability—combining existing map files using overlay methods to create environmental sensitivity maps.

examined that may meet the requirements for the particular type of training in question. Without use of a geophysical information system such as ERDAS, the alternatives would probably not be as apparent and would have to be evaluated manually.

How can techniques and results from this study be applied to Civil Works projects?

First, the ability to rapidly analyze many resource conditions simultaneously could greatly enhance the master planning process (for both new plans and updates). Additional data such as visitor information could be analyzed with the resource data to obtain increased visitor satisfaction through proper siting of facilities and matching facilities to visitor needs.

Second, the system could be used by project managers as an aid in decisionmaking. Resource allocations and rehabilitation decisions could be assessed in greater detail to give the manager a better understanding and balance for the complex relationships between resources and visitor satisfaction.

As the Fort Benning land-use study progresses, more applications for Civil Works functions will become apparent. Costly duplication of research effort could be avoided by adapting these methods to Corps problems.

NATURAL RESOURCES RESEARCH PROGRAM

This bulletin is published in accordance with AR 310-2. It has been prepared and distributed as one of the information dissemination functions of the Environmental Laboratory of the Waterways Experiment Station. It is primarily intended to be a forum whereby information pertaining to and resulting from the Corps of Engineers' nationwide Natural Resources Research Program can be rapidly and widely disseminated to OCE and Division, District, and project offices as well as to other Federal agencies concerned with outdoor recreation. Local reproduction is authorized to satisfy additional requirements. Contributions of notes, news, reviews, or any other types of information are solicited from all sources and will be considered for publication as long as they are relevant to the theme of the Natural Resources Research Program, i.e., to improve the effectiveness and efficiency of the Corps in managing the natural resources while providing recreation opportunities at its water resources development projects. This bulletin will be issued on an irregular basis as dictated by the quantity and importance of information to be disseminated. Communications are welcomed and should be addressed to the Environmental Laboratory, ATTN: A. J. Anderson, U.S. Army Engineer Waterways Experiment Station, P.O. Box 631, Vicksburg, MS 39180-0631, or call AC 601, 634-3657 (FTS 542-3657).

ROBERT C. LEE
Colonel, Corps of Engineers
Commander and Director