ANALYSIS OF METHODS OF DETERMINING RECREATIONAL CARRYING CAPACITY AND THEIR APPLICATION TO THE ILLINOIS RIVER IN OKLAHOMA

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CHAPTER I

INTRODUCTION

Physical Setting and Characteristics of the Resource

Located fifteen miles southwest of the city of Fayetteville, Arkansas in the northern Boston Mountains, the Illinois River begins its northerly and westerly flow through the Ozarks region. Crossing the Oklahoma-Arkansas state line near Siloam Springs, Arkansas, the course of the river flows southerly to its confluence with the Arkansas River in northeastern Oklahoma. Two major tributaries of the Illinois River include the Barren Fork and Flint Creeks. (The Barren Fork is variously spelled Barron and Baron on U. S. Geological Survey maps and in literature. For consistency the creek is spelled Barren in this document.) Both tributaries are traced to similar origins within the Ozarks and both flow generally west and south until uniting with the Illinois River in Oklahoma. The river corridor, totaling approximately 38,000 acres, encompasses 119 miles of the Illinois River and its two tributaries, along with a one-half mile wide corridor. Corridor is used instead of watershed because corridor is a legal definition, as written in the National Wild and Scenic Rivers Act as the area one-quarter mile on either side of the stream.

Thirteen miles upstream from its confluence with the Arkansas River in northeastern Oklahoma, the Illinois River has been dammed, forming Tenkiller Ferry Reservoir, a 12,900 acre conservation pool. The reservoir's purposes include flood control, water supply, power generation and recreation. In many cases the water in Tenkiller backs up to Horseshoe Bend Public Recreation Area at the lower portion of the river corridor. During times of flooding, the reservoir has backed up all the way to the city of Tahlequah.

Lake Francis was a 570 surface acre reservoir created by an impoundment on the Illinois, north of Watts, Oklahoma. The reservoir served as a water supply source for the community of Siloam Springs, Arkansas. Since Lake Francis backed up across the Oklahoma-Arkansas state line, its dam is considered the upstream limit of the Illinois River segment in Oklahoma. Lake Francis experienced major changes in floods during 1992 and 1993 with partially breaching of the earthen impoundment. This breaching of the dam has presented management concerns for water quality, release of sediment, and eutrophication.

The two impoundments found on Flint Creek include a small narrow reservoir located near the New Hope Ranch Youth Camp and an additional impoundment located outside the city of Flint on Highway 33. The Youth Camp reservoir provides recreation for camp purposes and is located about four stream miles west of the Oklahoma-Arkansas state line.

Though no impoundments are located on Barren Fork Creek, the waters of Tenkiller Ferry Reservoir may back up into the creek a distance of three stream miles during times of heavy rain.

The Illinois River and its tributaries are among the primary tourist attractions in northeastern Oklahoma. Canoeists and tourists from across Oklahoma, and parts of Arkansas, Missouri, Kansas, and Texas are drawn to the river corridor. Significant cities found within a few hours driving time of the river are Tulsa, Oklahoma City, Fort Smith, Fayetteville, Joplin, and Wichita.

No other streams in northeastern Oklahoma and few in the south-central part of the nation are as accessible or convenient to float (canoe, raft, kayak or innertube) as the Illinois River. Picturesque bluffs flank the river over much of its course, affording the user much scenic variety. The pastoral setting of the agricultural valley adds to the recreation enjoyment. Water quality continues to support diverse fish resources, although some

deterioration in the fishery has taken place and eutrophication has become evident in sections over the last twenty years.

Some significant events of local Indian history have taken place in the Illinois River area. For example, the Cherokee Tribe, having been ousted from southern Appalachia and after enduring the famous "Trail of Tears," founded their national capital at Talequah. Their cultural influence on the river valley continues.

Statement of the Problem

Many Oklahomans recognize the value of this resource and are striving to take steps to conserve it now and for future generations. The Oklahoma Scenic Rivers Commission has the responsibility for implementation and enforcement of the River Management Plan that results from this and other studies currently being conducted.

The purpose of this study is to analyze current and previous methods of determining carrying capacity of natural resources so that a method applicable to the Illinois River in Oklahoma can be developed for use by managing agencies to assist in the development of recreation opportunities that maximize the use of the resource while maintaining a specific quality of the resource for future users. This study was conducted as a precursor to the potential inclusion of the Illinois River in the National Wild and Scenic River system as a 2(a)ii river (47 CFR 39454, Tuesday, September 7, 1982 and USCA 16 § 1271 et al).

Four general objectives were identified during the early stages of the planning process of this project. These themes were determined to assist in identifying specific issues to be addressed. These objectives include:

1. to maintain and enhance the economic viability of existing resource uses and to develop a management plan that respects the rights of property owners;

2. to conserve and enhance instream biological and physical resources such as resident fish and their habitats, and water quality;
3. to provide appropriate recreational use and public access; and
4. to conserve and enhance land-based biological and physical resources such as plants, animals, riparian ecology, species diversity, historical archaeological resources and visual quality.

Questions to be answered include:

1. What are appropriate methods of measuring use of the resource? Is there one appropriate method?
2. Should water quality be included in the formula for determining recreational carrying capacity?
3. Should the river be zoned for different types of use, and, if so, where?
4. Does the number of people using the resource contribute to the degradation of water quality and surrounding area or is degradation a result of the kind of use the resource receives?
5. How do the managing agencies know when recreation carrying capacity has been reached?
6. Once appropriate measures of carrying capacity are established, who and how will those measures be controlled or enforced?
7. Is carrying capacity a sufficient measurement on its own, or should other methods also be used?
8. Should this study be concerned with streambank erosion, sediment additions to the river and beach erosion based upon the number of users?

9. Will certain types of management regulation, such as controls on consumption of alcohol, affect the recreational carrying capacity of the Illinois River?

Extent of the Study

This study draws on research done at many different types of natural resource settings, and, therefore, various types of measurements were applied to arrive at different types of carrying capacities. Most of the research consulted focuses on the social carrying capacity. The social carrying capacity measurements include such items as satisfaction, feeling crowded and allocating use. Zoning, management objectives, the Recreation Opportunity Spectrum, Limits of Acceptable Change and Visitor Experience and Resource Protection are also addressed. Difficulties exist for establishing carrying capacities. There are three which are addressed by different researchers using a variety of methods: 1) people have different wants, so there are different carrying capacities (Schreyer, 1976); 2) any use produces some change, and it is difficult to tell just how much change is too much (Hendee, J. C.; Stankey, G. H. and Lucas, T. E., 1978); and, 3) the number of users is sometimes a poor predictor of impact; even low amounts of use, for example, can severely impact plant communities (Cole, 1982).

Limitations

One difference in this river from many of the other rivers that have received National Wild and Scenic River status is that ninety percent of the land surrounding the river, including the banks, is privately owned. This presents a management issue as well as a cost issue that must be addressed when determining carrying capacity of any kind, due to the use of the land by the owners for the purposes allowed on private property. Any monitoring or other types of measurements would have to be conducted with the

permission of the land owner(s) and compensation might be necessary. Specific limitations of this study are that no actual instrument will be developed or tested.

Delimitations

This is a purely theoretical exploration of the methods currently being used to determine recreational carrying capacity. However, methodologies may be theoretically applied, and recommendations for application will be made.

Assumptions

It is assumed that:

1. The methodology suggested from this study will be tested at a later date, and modified, if necessary.
2. A variety of instruments exist for measuring use levels, satisfaction and perceptions of crowding.
3. Water quality is an issue for this resource, therefore, methods of measurement and control will be necessary, but will not result from this study.

Definition of Terms

These terms are defined as follows for the purpose of this study:

A. Damage

"...signifies a judgment that change which has occurred is undesirable" (Stankey, 1974).

B. Undesirable

"...judged by the relationship of the change to the management objectives which govern the area" (Stankey, 1974).

C. Carrying Capacity

"...the level of recreation use an area can withstand while providing a sustained quality of recreation" (Wagar, 1964)

D. Management Objectives

"specified in measurable and attainable ways what the manager visualizes resulting from managing recreation places and information" (Brown, 1985).

E. Ecological Capacity

"is concerned with impacts on the natural environment. Examples of ecosystem impact parameters include percent of viable ground cover, ratios of various plant species, numbers of animals observed, and coliform counts" (Shelby & Heberlein, 1986).

F. Physical Capacity

"is concerned with the amount of actual space, so impacts can be referred to as 'space impacts'. Examples of space impacts include people per square mile or acre, number of people in critical areas, number of canoes per stream mile, number of times a canoe floats down the river and number of camping parties per beach or campsite" (Shelby & Heberlein, 1986).

G. Facility Capacity

"involves improvements intended to handle visitor needs. Facility impacts can be referred to as number of people, groups or vehicles per launch area, rest room, parking lot, campground; percent occupation for various facilities, visitor-staff ratios and flow-rate of the river." (Shelby & Heberlein, 1986).

H. Social Capacity

"the level of use beyond which impacts exceed levels specified by evaluative standards" (Shelby & Heberlein, 1986).

I. Acceptable

"...emphasizes the idea that the amount of change that occurs reflects a judgment made about its appropriateness" (Stankey, McCool & Stokes, 1984).

J. Limits of Acceptable Change (LAC)

"is a recognition that change is a natural, inevitable consequence of recreation use, and that inevitable impacts that occur are a result of human use. This method of management focuses on managing for desired conditions rather than on how recreation per se should be managed" (Stankey, McCool & Stokes, 1984).

K. Recreation Opportunity Spectrum (ROS)

is a system of land classification based on the principle of diversity for provision of diverse recreational opportunities on public lands (Driver & Brown, 1978).

L. Recreation Opportunity Guides

are methods of inventorying recreation opportunities and presenting them to the public in the form recommended by the National Forest Service. This process results in disseminating current resource management policies and knowledge of health, safety, and environmental education (USDA, Forest Station, Southwest Region).

M. Motivation

is determined by the attractiveness of outcomes and the expectancy that a given effort will result in the desired outcomes (Vroom, 1964, in Schreyer & Roggenbuck, 1978).

N. Expectancy

is the momentary belief that a particular act will be followed by a particular outcome (Schreyer & Roggenbuck, 1978). It is influenced by such personal characteristics as past experience and self-concept, and by such social variables as communication and the support of one's reference group, the actual situation, and self-esteem and dominance. (Lawler, 1973, in Schreyer & Roggenbuck, 1978).

O. Unique

"indicates a human judgment about relative rarity" (Wagar, 1974).

P. Recreation Resource

"is a judgment that a part of our environment is useful for some human purpose" (Wagar, 1974).

Q. Decreasing marginal utility

"the more we already have of some good or value, the less importance we place on each additional unit of it" (Wagar, 1974).

R. Lotteries

are a device through which applicants are chosen at random and for which the probability of being chosen is equal for all applicants (McCool & Utter, 1982).

S. Travel Pattern Concentration

are areas in recreation settings where visitors choose to concentrate for particular purposes (Chilman, 1983).

T. Succession

is any sustained change in the character of recreational use of a resource that is predictable (Schreyer, 1979).

U. Displacement

is any change in recreation behavior to maintain satisfaction in response to changes in the recreation environment (Schreyer, 1979).

Methodology

A case study approach was utilized to determine if carrying capacity is an appropriate measurement to be implemented on the Illinois River. The methodology for this process is one of compilation of resources and methods for determining carrying capacity, reflection upon that information and recommendation of one or more

methodologies or combination of methodologies that could be applicable to the Illinois River corridor and approved by the National Park Service for the inclusion of the Illinois River in the National Wild and Scenic River program. During late-1993 and early-1994, public hearings occurred and the information obtained from those hearings changed the direction of this study to include more than just an exploration of the recreational carrying capacity of the Illinois River.

CHAPTER II

Information Related to Public Hearings

Public hearings have occurred in many cities surrounding the Illinois River in order to obtain input from the public and various interest groups concerning the Illinois River and the potential for inclusion as a 2(a)ii river in the National Wild and Scenic Rivers Act. Concerns have been voiced relating to private citizen's rights to use private property adjacent to the Illinois River. Many owners favor doing something to save the river, as long as it does not interfere with their choice of use of their private property. Other concerns include the use of alcohol by floaters, the image of the river as being a "party river" which may exclude certain potential users based on reputation, litter along the river banks and on private property, lack of adequate sanitary facilities along the developed portions of the river, and concern with the potential for clear cutting to occur on land immediately adjacent to the Illinois River. Several outfitters also expressed reluctance to accept carrying capacity if the concept were limited to recreation. They preferred a management plan that would address all uses of the Illinois River watershed.

Many persons who have spoken at these meetings have failed to address the issue of economic impact of the Illinois River on the surrounding communities. They have also failed to discuss the implications for recreation outside the immediate vicinity of the river itself. The lack of discussion of these two issues raised questions in the mind of the researcher concerning the true motives and purposes of the persons attending the meetings. The public hearings demonstrated a sense of personal ownership of the river developed by individuals who derive personal income from the river. There was a distinct

lack of "public good" in the discussion presented by those relying on the river for recreation or livelihood.

Literature Related to Carrying Capacity

Many methods exist for measuring the carrying capacity of natural resources, from wilderness areas to range land to rivers. Management agencies seek out this type of measurement in the form of a "magic" number that will allow quantification and control of the use of the resource. Many studies recognize the desire by management to produce this type of measurement (Frissell, Lee, Stankey, & Zube, 1970) and strive to determine just what that "magic" number is and how to measure it. The studies also recognize that management objectives and parameters are a vital component of the both the decision making process of what to measure and the measuring processes employed (Frissell, Lee, Stankey, & Zube, 1970).

Management Objectives and Use Limits

"Outdoor recreation is primarily a psychological experience whose quality may depend as much (or more) on a persons' expectations, belief systems and prior experiences as on the physical condition of the area visited" (Wagar, 1964). Wagar suggests that the reasons for limiting use reside in the characteristics of a specific site and not in its contribution to human experiences. He further suggests that carrying capacity obscures the distinction between technical issues (involving what can be) and value choices (involving which of various possibilities ought to be). "Thus every statement for recreational carrying capacity includes the assumption (often not explicitly stated) that unacceptable consequences will occur if use is permitted at a higher level. Defining what is acceptable, however, is a value choice rather than a technical issue" (Wagar, 1974). He

also states that a range of potential capacities is necessary so that a wide variety of consequences are available.

"From the viewpoint of society, the objective of all resource management is to create and maintain a flow of benefits for people. This man-centered objective is far broader than it may first appear because benefits embrace anything that makes a person better off. Thus, they include emotional as well as material values." If a stream of benefits is to be maintained, then the resource must clearly be protected. It is important to examine the biological factors that determine an area's durability and capacity for self-repair to determine how the area may best be managed and used. "But we must not forget that protecting and managing resources are means, not ends" (Wagar, 1974).

> Rather than base our actions on claims of absolute worth for selected attractions, it seems more productive to start with the underlying basis for our judgments of worth. Our most powerful arguments for such values as wilderness, solitude, whooping cranes and redwoods is that many of us judge our lives to be enriched by their presence. We maintain diversity and uniqueness for the current and future benefits they provide for people, not to benefit the attractions themselves (Wagar, 1974).

Wagar suggests looking at the resource from at many points of view, and utilizing the economist's concepts of decreasing marginal utility and marginal analysis. He warns, however, that using a scarce resource to provide a commonplace opportunity could lead to long-term losses far exceeding short-term gains. It would be better to opt for sustained benefits as opposed to immediate benefits that taper off once the resource is exploited. There must be tradeoffs in shifting areas from one type of use to another. Eventually, the benefit created by the shift from one use to another will exactly offset the benefit lost by taking the original use and shifting to the new use. Economic terminology would have the marginal utilities being equal and, because no pattern of substitution of uses will increase the sum of all benefits, benefits are at their maximum.

Zoning is a tool for defining use limits. "To prevent all opportunities from being reduced to the lowest common denominator, and to prevent rare and unique opportunities

from being converted to conditions that are already abundant, the obvious solution is to create an integrated and highly visible system of areas and zones" (Wagar, 1974). Intensity of use is one factor in defining zones, but one must also consider physical site characteristics. Use limits will only be appropriate, according to Wagar:

> if they are at least as effective as other means of achieving the same ends..... Use limits are therefore to be found primarily within human purposes and judgments of quality. Although physical characteristics may define a site's initial durability, the decision to limit use rather than "let the site deteriorate," "intensify management," or even, "pour more concrete" is dictated by human objectives, not ecological imperatives" (Wagar, 1974).

Perceptions of Crowding

Management objectives are often stated in very broad terms, such as "for the benefit and enjoyment of the people." While this is an objective statement, it is not specific and does not provide any guidance to management. Often, the ambiguity of such a statement allows for considerable variation in personal judgment such as carrying capacity (Schreyer & Roggenbuck, 1978).

Schreyer and Roggenbuck (1978) tie crowding perceptions to differing expectations that people may have for a recreation experience. They also state that crowding, or the perception of crowding, is often treated as a general psychological attribute, rather than as a situation-specific attribute. This model relies on expectancy theory and discrepancy theory. "Expectancy is the momentary belief that a particular act will be followed by a particular outcome. Different people can have different expectations for the same desired outcome, and an individual can have different expectations regarding a given outcome through time." Some conclusions that can be drawn from the literature addressing expectancy theory are: 1) people have a variety of expectations for participating in recreational activities; 2) the expectations for participating in one recreation activity are usually different from the expectations for participating in another activity; 3) people

engaged in the same activity sometimes seek different outcomes; 4) different types of recreationists using the same environment sometimes seek different outcomes; and 5) such antecedent conditions as demographic, socio-economic and environmental variables have seldom, by themselves, been useful in explaining and predicting the motivations of recreationists.

The discrepancy theory suggests two major propositions: "1) satisfaction is determined by the differences between the *perceived* outcomes an individual receives and the outcomes wanted or thinks he should receive; and 2) overall satisfaction in any situation is influenced by the sum of the discrepancies that exist for each facet of the situation." This theory provides no conceptual basis concerning why some outcomes are more valued than others and it does not specify variables which influence the perception of how much of an outcome an individual receives. Roggenbuck (1975) suggest that this theoretical deficiency is overcome largely by tying discrepancy theory to the expectancy theory of motivation.

"Expectancy and discrepancy theories suggest that dissatisfaction in recreation due to crowding is a function of the discrepancy between the numbers of others one expects to see while participating in the activity and the numbers one actually encounters" (Schreyer & Roggenbuck, 1978). This application does not factor in the functions of locations of encounter, mode of travel, size of group or behavior of others. This approach suggests that some expectations may be density dependent, (i.e., subject to disruption through crowding) such as desire for solitude, while other expectations may be for action and excitement, which may be satisfied at higher use levels than desire for solitude. This theory was explored utilizing whitewater recreationists in Dinosaur National Monument.

A questionnaire was given to recreationists as they disembarked from their trips at the Split Mountain boat ramp, which was the termination point for all boat trips. The questionnaire measured respondent's attitudes toward management strategies for the resource, perceptions and evaluations of encounters with others on the trip, a wilderness

attitude scale that measured experience expectations and certain background and trip related variables. Points of decision suggest that a greater degree of attention be given to the diversity of expectations for experience which may exist within a given activity. Schreyer and Roggenbuck (1978) further state that "if differing sensitivities to crowding are a function of certain experience expectations and the ability of the presence of others to prevent the satisfactory attainment of those desired experiences, then the determination of crowding must be a function of objectives which identify specific experiences to be provided by management." They further state that "decisions should be based upon the relative congruence of expectations with the management goals for the resource. If objectives are not set in terms of providing specific experience opportunities, then the assessment of crowding will be a function of the average perceptions of the present users, regardless of the nature of their expectations." This type of management decision making may lead to current participants seeking other opportunities elsewhere due to the change over time of users who do not have density dependent expectations in order to be satisfied with the recreation experience available. "Thus, a decision not to manage to provide opportunities for specific experiences is in fact a decision to manage for density-independent experiences."

While this approach provides information on current users, it is only a "snapshot" of a particular point in time. The response may not be representative of the nature of the resource or of the activity. "If perceptions of crowding are not experience-specific but rather user-specific, then trying to assess crowding through analysis of current users may be no more useful than trying to understand ecology by taking a single picture of a hillside. Rather, we should be concerned with the kinds of experiences we are attempting to provide opportunities for, and then assessing the sensitivity to crowding associated with those experiences" (Schreyer & Roggenbuck, 1978). Management objectives need to be in place first, then assess the qualities and quantities, because objectives, qualities and quantities could change over time.

Satisfaction means different things to different people (Ditton, Graefe & Felder, 1981; Schreyer, 1979; Manning & Ciali, 1980). Measuring satisfaction has been done by many researchers in the field. Interviews are the most utilized technique (Ditton, Graefe & Felder, 1981; Schreyer, 1979; Manning & Ciali, 1980). Some studies only explore the overall concept of satisfaction (Manning & Ciali, 1980) and do not determine what variables interact to cause a certain level of satisfaction to occur (Ditton, Graefe, & Fedler). Ditton et al. further define measures of satisfaction by utilizing measurement scales (Likert type). They further suggest that "explanations of satisfaction can be enhanced by identifying and formulating separate predictive models for more homogeneous groups of river floaters". Most research in the area of satisfaction is completed with samples that are heterogeneous, and therefore random, but these samples may not be truly indicative of the true levels of satisfaction, taking into account participants changing their definition of satisfaction and appropriate contact levels (Manning & Ciali, 1980).

Limits of Acceptable Change (LAC)

Limits of Acceptable Change as a model for determining carrying capacity was explored as part of an interdisciplinary consulting group that consisted of the National Park Service and the master plan team for Yosemite Valley (Frissell, Lee, Stankey, & Zube, 1970). LAC method has also been used to examine the Bob Marshall Wilderness Complex (Stankey, McCool & Stokes, 1984). Many of the concepts of LAC were put forth by Frissell and Stankey in 1972. This methodology recognizes that some changes are inevitable as a result of human use (Stankey, McCool & Stokes, 1984). The challenge is to define the limits to the changes resulting from use and manage the resource to keep within the defined limits.

Two major assumptions exist if the focus is shifted from traditional carrying capacity determinations to LAC. First, attention is shifted from use-level as the key management parameter to the environmental and social conditions desired in and of the resource and how to achieve them. Specific solutions need to be sought for specific problems, rather than concentrating on controlling the amount of use.

> Use per se is not the issue; it is the impacts that use produces with which we are concerned. In controlling these impacts, management actions other than the direct limitation of use likely will prove desirable. Visitor education could solve a problem of littering or improper waste disposal, for example. Education or regulation to change visitor behavior could reduce some types of impacts.

The second implication is that carrying capacity is a prescriptive issue rather than a technical one. Traditionally, the task was to define the level of use beyond which excessive impact would occur, a technical process that involves understanding the relationship between use and change. However, LAC addresses the issue of acceptable change, and this answer is based upon judgment, not just technical research. Judgment requires input not only from managers, but the public and researchers as well. Strategies for achieving acceptable change will still need technical, scientific information, but defining acceptable change is a matter of setting objectives (Lucas & Stankey, 1985).

Research needs for LAC include information about the resource, its use and about the effect of management on both. Much of the research will be area specific. There are nine interrelated steps in the LAC framework. Briefly, (Stankey, et al. 1985) the nine steps follow:

1) Identify area issues and concerns;
2) Define opportunity classes;
3) Select indicators;
4) Inventory existing conditions;
5) Specify standards;

6) Identify alternative opportunity class allocations;

7) Identify management actions;

8) Select a preferred alternative;

9) Implement actions and monitor conditions.

Since many steps exist in this process, there are many measurement techniques needed to accurately assess and determine the Limits of Acceptable Change. What follows is a brief synopsis of the techniques utilized to arrive at management decisions based upon the Limits of Acceptable Change model.

Measurement techniques include determining what issues are important to visitors and interested publics, their ranking and their priority for solution. Thus, identification of variables and indicators is necessary to determine the importance of different potential indicators in terms of their effects on the ecosystem and the visitor. For practicality, the number of indicators must be limited; thus, if research could analyze the interrelationships among various possible indicators and suggest which reflect or precede others, managers could select efficient, sensitive indicators (Lucas & Stankey, 1985). Determine what data are critical to the planning process and use that information to assist in inventorying existing conditions. These conditions could include social indicators such as conflicts among user groups and contact levels, and others as deemed necessary by the planning agency.

Quantitative standards are stated in the form of objective measures of acceptable conditions. Research must be done that focuses on the consequences and implications associated with different levels of standards. Social research can assist in providing data about preferences, expectations and judgments of acceptability held by users that can be used to establish resource and social standards.

Research is a tool that should be utilized to focus on the feasibility of different management strategies. This assists the managing agency in determining the likelihood of effectiveness of different management actions. Management should also analyze the

various costs and benefits associated with each alternative and its associated management strategy, and how each will impact users and managers. Then, the agency can utilize social research to determine opportunity costs associated with the different alternatives that are not subject to monetary estimation.

Once these steps have been taken, implementation begins and the agency begins to monitor the situations to provide systematic data on conditions so that the effectiveness of a particular management strategy can be determined. This methodology is very involved and takes some careful planning, but is very systematic and incorporates many aspects of the resource as well as the user. LAC removes the focus on "how much use is too much" and applies the concept of "how much change is acceptable".

Zoning

Zoning allows for different experiences from the same resource. Management can utilize zoning as a method of managing the river (i.e. put-in and take-out zones) (Bristow, Chilman, Foster, & Everson, 1988) as well as creating zones that manage for density (Greist, 1975 & Van Wagtendonk, 1985).

Van Wagtendonk conducted carrying capacity studies for the Yosemite Wilderness. This study utilized existing data and a familiarity with the Park's wilderness ecosystems to reach a decision. Maps already existed that defined travel zones, trails and ecosystem types in the Yosemite Wilderness. Zones were determined using a process suggested by Linn (1972, in Van Wagtendonk, 1985). Density guidelines were first applied to the number of acres and miles of trails in each zone. The values were further altered by a fragility factor which related the ability of the ecosystem type to withstand use. While space standards are often not based on sociological or ecological research, they have developed from intuitive judgment and field experience (Lime & Stankey, 1971). As such,

they represent a "first cut" for determining carrying capacity and should be refined when research studies relating density to satisfaction and ecological impact become available.

Ecological fragility was measured with a scale on rarity, vulnerability, recuperability and repairability. The scale went from 0 (meaning common, not vulnerable, easily repairable and extremely capable of recuperation) to 9 (being unique, very vulnerable, not easily repaired and not capable of recuperation). If a zone included more than one ecosystem type, the ratings were weighted by the proportional areas of those types (Van Wagtendock, 1985). Maximum capacity calculation for a zone is calculated from the social density, the acres of the zone and an adjustment for the number of miles of trail per square mile in the zone.

Griest (1975) utilizes risk zoning, which is based on an exact application of the definition for capacity--the use level demanded by users after they consider the costs. The study conducted by Griest utilized backcountry and wilderness areas, and assumed that all wilderness visitors value solitude. His result is a measure of social and ecological carrying capacity based upon user attitudes that include both affective and behavioral components. Griest incorporates the limits of acceptable change into his system of zoning by establishing LAC from the visitors point of view and comparing it with the LAC established by management using other technical or legal criteria. The final determination of carrying capacity will be based upon the lesser of these limits.

This plan utilizes a permit system for access to the resource based on the existence of zones with various levels of intensity for use. The potential visitor must determine which type of experience is desired (i.e. solitude, naturalness of the resource, high use area, etc.) by weighing the cost of visiting that particular area. The percentages of visitors admitted to the zones are inversely proportional to the severity of use limits in each zone. An applicant is informed of the use-level opportunities for solitude and naturalness and the consequent costs: the probabilities of having the permit rejected. The applicant is also informed that losers are not allowed to reapply for a permit to any zone

for a specified time, which means that costs of permit approval will probably weigh into zone selection determination. The determination of carrying capacity for each zone should be adjusted to reflect the demand of popular zones and use times (Griest, 1975).

This approach is different from the one taken by many managing agencies: "provide the ideal park experience" in hopes that visitors will eventually discover this ideal and be dedicated to it. Users are given the power of judging the kinds of opportunities that should be supplied (Griest, 1975). This approach may cost more to the managing agency of this study, although some form of zoning does exist at the present time for the Illinois River and its named tributaries in the Oklahoma Scenic Rivers Act (OSA 82 § 1451 et seq.). The costs associated with this type of zoning include the initial cost to study the zones applied by the users to the resource, the longitudinal nature of this type of study and the need to repeat this study as the users redefine the zones and to disseminate this information to the public.

Allocation of Use

A permit system is currently in place on the Illinois River for commercial outfitters. Commercial permits are $5 per commercially owned and operated flotation device. Persons with their own boats that do not utilize any livery services are required to pay a $1 use fee per boat that floats down the river. Property owners adjacent to the rivers under the operating area of the Scenic Rivers Commission may own and operate one canoe for their individual use without paying the use fee. Visitors who use a livery service are charged this fee in the cost for boat rental by all the liveries and that fee is then paid by the liveries to the Oklahoma Scenic Rivers Commission. Allocation of use is not a new concept to the Illinois River, but limitation of use is not a concept met with favorable opinions by all of the livery operators. Several methods exist to administer systems that allocate use.

Allocation of use is a tool with which to record and monitor use levels on the river. It is a measurement of the number of boats that float the river on any given day. The number of people accommodated can be estimated based upon the number of boats multiplied by the average number of people per boat type used. Data gathered this way could assist in determining the carrying capacity, as defined by the users. This also provides information concerning high and low use times. However, the current system on the Illinois River does not monitor how many times a permitted canoe goes down the river per day. Some liveries have more permits than actual boats, and one boat may float the river three to seven times per day. Permits are paid for once a year and allocation is based upon the figures from 1977 (Personal correspondence, Ed Fite).

Lotteries have been used on many western whitewater rivers where application for private use greatly exceeded established capacities (McCool & Utter, 1982). Commercial operators are also allocated use permits based upon the determined carrying capacities of the resource and it is the remaining permits that are in the lottery system for private users.

Studies exist that examine the techniques for allocating use and the perceived satisfaction for both the accepted applicants and the rejected applicants (Utter, Gleason & McCool, 1978; McCool & Utter, 1982; Shelby, Danley, Gibbs, & Petersen, 1982). The studies support the use of some form of lottery as an equitable device for issuing permits.

It is worth noting that public access points to the Illinois River are abundant, and they include marked access points as well as bridges that cross the river. The carrying capacity of these sites may need to be evaluated in terms of recoverability and sustainability as part of the recreation experience.

Recreation Opportunity Spectrum (ROS)

The Recreation Opportunity Spectrum "is based upon the principle of diversity. The objective is to provide a diverse range of recreational opportunities on public lands in

order to satisfy a wide range of recreational demands" (Lichtkoppler & Clonts, 1988). A key assumption of the ROS concept is that quality in outdoor recreation can best be insured by providing such diversity (Clark & Stankey, 1979). This is the spectrum approach.

An underlying assumption of the ROS is "that people seek satisfactory recreational experiences by participating in their preferred recreational activities in a preferred environmental setting. To provide varied opportunities. . . as well as protect the resource upon which they depend, the managing agency applies the ROS criteria, which is a mix of physical, social and managerial parameters, to match specific recreational opportunities with compatible resource qualities" (Lichtkoppler & Clonts, 1988).

Land areas are identified as belonging to one of six classes depending on the level of existing or planned development and human influence. The classes are, in order of decreasing development and human influence: urban, roaded natural, semi-primitive motorized, semi-primitive non-motorized, and primitive (USDA Forest Service, 1986).

Lichtkoppler and Clonts (1988) felt that the forests of the eastern United States were different from those in the west in which ROS was first used. In order to recognize differences in planning and managing eastern forest land, they altered the classifications and chose five characteristics to integrate the LAC concept with the ROS. Indicators were: 1) access; 2) development; 3) user density; 4) vegetation; and 5) environmental change. These indicators were chosen because "they can be quantified and utilized. . . by field personnel with a minimum of training and equipment." The researchers also examined visitor characteristics pertaining to socioeconomics, travel time and travel distance to the resource.

The management objective of ROS is to manage the resource base either to maintain the current classification or manage to change the classification according to criteria (Lichtkoppler & Clonts, 1988). Monitoring is used to document changes and trends that may be occurring (Chilman, 1985). After the spectrum is determined, a Recreation

Opportunity Guide is created to assist the visitor in choosing an appropriate location for the desired experience.

Chilman (1985) presents recreation resources as visit experiences to particular areas, and those experiences are "renewable in the sense that they can be managed so that visitors may have a good chance of repeating desired experiences during future visits".

> Wagar (1966) has proposed that quality means different things to different recreation visitors; hence, a range of recreation opportunities should be provided so that individual visitors may choose a recreation opportunity closest to their desired experience on a particular trip. . . .This means a need to know what spectrum of recreation opportunities is provided in this area and surrounding region, and how a particular recreation setting fits into the spectrum. Then when visitors choose to visit this particular setting, they may be surveyed about what the important (quality) aspects of the setting are for their desired recreation activities, and managers can work to maintain or improve these aspects (Chilman, 1985).

Chilman uses Travel Pattern Concentration (TPC) areas for inventorying and monitoring resources. The characteristics measured relate to describing the setting, visitor use patterns (where, when, how much) and associated site impacts, and visitors' perceptions of quality attributes of the setting and management actions needed to maintain or improve quality. Inventory measurements include physical, biological and social phenomena. Physical measurements may include amounts of the streambank eroding into the river. Biological measurements relate to impact on vegetation or wildlife. Social measurements include recreation visitor numbers, types, patterns of use and perceptions of conditions (Chilman, 1985).

Chilman (1985) explored three different types of areas that were relative to developing monitoring methods of recreation use and quality. Those areas were an off-road vehicle (ORV) riding area at Land Between the Lakes in Kentucky and Tennessee, Desolation Wilderness in California, and Ozark National Scenic Riverways. Site impacts and visitor use surveys were conducted at the Turkey Bay ORV site (Chilman & Mize, 1977). A ten question form was utilized by wilderness rangers while performing their

regular work schedule in the Desolation Wilderness (Chilman, 1984). The Ozark National Scenic Riverways combined counts and short visitor interviews at major river access points at eight of the ten river zones.

The purpose of the Ozark National Scenic Riverways study was to determine if carrying capacity could be based upon the concept of maintaining different use densities and float conditions on various river zones, so that visitors could choose a preferred float experience setting. Two questions were of primary concern: 1) Did differences in river use densities exist in different zones? and, 2) What were canoe floaters' perceptions of conditions on the individual zones? (Chilman & Everson, 1985).

Succession and Displacement

Behavioral change is related to the managerial consideration of user dissatisfaction. "Displacement represents a change in behavior resulting from failure of present opportunities to provide desired outcomes. Further, the changes of greatest concern are those dealing with changes in numbers and behaviors of others that result in dissatisfaction. Displacement is a special case of user conflict in recreation" (Schreyer, 1979). Managerial decision making in providing opportunities and/or constraints can be a factor in the conflict. "Succession is not an invariable process, but rather is characterized by the interactions of recreationists acting on different motives and the conditions present in the recreation environment. The presence of others constitutes a changing part of the environment, as do decisions by management about regulations and facilities. It is the change fostered by these interactions that we describe as succession" (Schreyer & Knopf, 1984).

Manning and Ciali (1980) relate increasing use densities with displacement. "Recreationists who become dissatisfied with increasing use densities may move on to less crowded areas, being displaced by user with norms more tolerant of higher recreation

densities. In this way, satisfaction remains high regardless of use density, though it is satisfaction expressed by different populations of recreationists." Schreyer and Knopf (1984) use recreational canoeists as an example: "canoeists may perceive a favorite stretch of river as becoming overpopulated with non-traditional users, and elect to search for a new environment that may more closely fit their desires".

Displacement has been tied to use levels (Schreyer & Knopf, 1984; Becker, Neimann, & Gates, 1981; Anderson, 1981; Roggenbuck, Wellman & Smith, 1980; Neilsen & Endo, 1977) in some empirical studies and to user satisfaction in others (Becker, 1981; Manning & Ciali, 1980; and Ditton, Graege & Felder, 1981). Schreyer and Knopf (1984) have deduced six concepts crucial to understanding succession and displacement:

> First, people value the psychological products or outcomes of a recreation activity more than the activity itself. . . .Second, . . . people pursue an activity in search of multiple goals. . . .Third, people engaging in different activities seem to be searching for different mixes of outcomes (Tinsley, Barret & Kass, 1977). Fourth, while differences across activities are significant, profiles of motives among recreationists participating in the same activity are not entirely homogeneous. . . The general view is that people pursuing the same recreation activity, but having different motives, will prefer different environmental settings (Driver & Brown, 1978). . . .Further, they will likely exhibit different behaviors within the same activity in pursuit of those varying motives. . . Fifth, recreation satisfaction is seen as the degree to which desired outcomes are actually realized while participating in a recreation experience (Propst & Lime, 1982). . . .Sixth, recreationists vary in the amount of importance they attach to the goals they are pursuing (Moore & Buyhoff, 1979).

Rivers studied by Becker (1981) include the Upper Mississippi and the Lower St. Croix Rivers in Minnesota and Wisconsin; Manning and Ciali (1980) studied river recreationists in Vermont; Anderson (1981) studied the Minnesota Boundary Waters Canoe Area; Roggenbuck, Wellman and Smith (1980) studied whitewater canoeists in Virginia; and Nelson and Endo (1977) studied river runners in the Grand Canyon.

Methodologies utilized were interviews of users, most often as they were leaving the

resource at the end of their river experience. Becker (1981) suggests that relationships between density and satisfaction are difficult to show with a single site study.

Visitor Experience and Resource Protection (VERP)

Carrying capacity has been a mandate of the National Park Service since 1978, when the 1978 General Authorities Act required each park's general management plan to include "identification of and implementation commitments for visitor carrying capacities for all areas of the unit". VERP is a relatively new concept that encompasses a prescription of desired ecological and social conditions. VERP defines carrying capacity as "the type and level of visitor use that can be accommodated while sustaining the desired resource and social conditions that complement the purposes of the park units and their management objectives" (Hof, et al., 1994). Measures of appropriate conditions replace measurements of maximum sustainable use.

This plan is a combination of LAC and the National Parks and Conservation Association's visitor impact management (VIM) methodologies (Graefe, et al., 1990; Lime & Stankey, 1971). Management goals, which are qualitative in nature, are quantified into measurable management objectives through the use of indicators and standards. Hof, et al. (1994) state:

> As conceived, the process will identify and document the kinds and levels of use that are appropriate, as well as where and when such uses should occur. The prescriptions, coupled with a monitoring program, will give park managers the information and the rationale needed to make sound decisions about visitor use, and gain the public and agency support needed to implement those decisions. . . Measurable indicators will be selected for monitoring key aspects of the visitor experience and resources, then standards will be assigned based upon management goals. When standards are exceeded, land managers must take action to get an indicator back within its defined standard. In a complex park, the park will also be zoned to reflect management goals for different areas.
>
> Then, specific indicators and standards would be selected for each zone. Indicators are divided into two types: biological physical indicators and social

indicators. Social indicators measure impacts on park visitors that are caused by interactions with other visitors or with park or concession employees. Biological physical indicators measure the impacts to the biological or physical resources of a recreation area.

VERP is comprised of a nine step process, summarized below:

1) Assemble the project team.

2) Develop statements of purpose, significance, and primary interpretive themes.

3) Map and analyze resources and visitor experiences.

4) Establish the spectrum (or range) of desired resource and social conditions (potential management zones).

5) Use zoning to identify proposed plan and alternatives.

6) Select quality indicators and specify associated standards for each zone.

7) Compare desired conditions to existing conditions.

8) Identify probable causes of discrepancies between desired and existing conditions.

9) Develop / refine management strategies to address discrepancies.

Steps one through six constitute general management planning. Steps seven, eight and nine can be done by park management people who can then reevaluate indicators and modify them, if necessary. During 1993 and 1994, a pilot project utilizing VERP was underway at Arches National Park. Methodologies include evaluating potential indicators to measure impacts from visitor use, personal interviews with visitors (Manning, Lime, McMonagle & Nordin, 1993), and focus group sessions with visitors, park staff and local community residents. An additional sampling technique is being utilized that involves image capture technology and ratings of acceptability by respondents (Nassauer, 1990; Chenoweth, 1990; Pitt, 1990; and Lime, 1990).

Other methods of measuring carrying capacity have been developed and tested, but they are resource specific and sometimes quite mathematically involved, which can make

them impractical for use on a day to day basis. The limiting factor matrix was utilized to measure the carrying capacity of the Glen Canyon National Recreation Area whose main recreational resource is Lake Powell. The study measured launch rates and distribution on the lake as well as visitor preferences (National Park Service, 1987).

Penz (1975) utilized a linear programming model that represented visitor movement via transitions matrices. Data collection was primarily based on existing information such as use permits and observations, with some visitors completing trip diaries. Many other measurements must also be collected to put into the formula that determines carrying capacity.

Often, the measurements are the responsibility of the managing agency after a study of this type is conducted. Since this may be the case, the measurements must be feasible for the managing agency to accomplish, both financially and physically. The measurements also need to be applicable to the goals and objectives of the managing agency. The managing agency needs to recognize and plan for the fact that a river ecosystem is not static in nature. The goals and objectives may change over time to reflect the determinations of carrying capacity as well as the improvement or deterioration of the resource.

The river ecosystem is dynamic; therefore, the types and frequencies of measurements must reflect the dynamics of the system as well as the goals and objectives of the managing agency. "Examining current users gives information only on one situation and that is likely a static one within a dynamic system" (Schreyer & Roggenbuck, 1978). There is not one "magic" number that controls or limits the use of the resource (Stankey, McCool & Stokes, 1984). The data generated assists the managing agency in making informed decisions about the quality of the resource and the recreation experience and the quantity of users that receive a quality recreation experience, as defined by the managing agency.

CHAPTER III

FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

Findings

The purposes of this study were to determine appropriate methods for measuring recreational carrying capacity, determine if zoning is appropriate for this resource, use and effect of regulations as related to recreational carrying capacity, and determine if types of use or number of users affect water quality and the quality associated with the recreation experience. The findings are based upon the literature review and on information from public hearings.

Many methods of measuring carrying capacity have been tested in natural resource settings throughout the country. Utilizing only one of the methods outlined previously will limit the managing agency. Goals and objectives of the managing agency must first be specified prior to establishing any type of measurement related to carrying capacity. One specific, appropriate method does not exist. A combination of methods based upon the goals and objectives of the managing agency will best accomplish this task.

Water quality is directly related to the recreational carrying capacity of the Illinois River. However, inclusion of water quality measures in the assessment of recreational carrying capacity must follow the goals and objectives of the managing agency. If the water quality can be quantified and determined to be related to or caused by recreation, then it is one appropriate measure for determining recreational carrying capacity.

Various methods have been implemented to report water quality. One popular method is Total Measured Dissolved Particles (TMDP), a technique discussed during the

Carrying capacity is a complex concept that requires planning and foresight on the part of administrators, visitors and resource protection groups. There are many types of carrying capacity, and a combination of those types would be most effective in determining such items as use levels, densities per zone, satisfaction of visitors, perceptions of crowding and ecological capacity of the resource. Current systems exist that combine these measurements in different forms to measure carrying capacity. Limits of Acceptable Change, Recreation Opportunity Spectrum, and Visitor Experience and Resource Protection are three such models.

Streambank erosion, sediment additions to the river and beach erosion need to be addressed when determining carrying capacities. However, this study focuses on the recreational carrying capacity of the river, and does not address the biological and ecological factors that affect the resource. Another planning group has been responsible for the water quality assessments and measurements, but they must work in conjunction with the recreation group in order to provide the best management plan for the Illinois River. The Oklahoma Scenic Rivers Commission needs to work with these groups and the appointed management for the Illinois River to determine management objectives that will address these problems and how they relate to the determination of carrying capacity. By addressing these biological and ecological factors, the resource is conserved and possibly improved.

The public hearings also revealed concern by outfitters and members of the general public on use of alcohol during recreation, and the discarding of containers for alcoholic beverages. Studies have shown that alcohol is an expected part of an outdoor recreation experience for many Oklahomans (Caneday, 1984 and Caneday, 1985).

Regulation of alcohol consumption on the river has been proposed either through limitation of containers or restriction of all alcoholic beverages. The rationale for such a restriction has centered on safety, improved quality of recreation experience, and removal

of a major litter source. Such regulation would be difficult to enforce due to the large number of visitors and the small number of employees of the Scenic Rivers Commission.

Recreational carrying capacity could be affected if such regulation of alcohol consumption were implemented. Regulations could eliminate consumption of alcoholic beverages during recreational use of the river; or, they could limit the amount allowed per party of floaters. Management could also decide to charge for every container that could possibly contain alcoholic beverages. Any regulation of this type will in some way affect the carrying capacity (most likely in terms of density and satisfaction), but the effects will not be known until a study is conducted. Such a study would best be conducted prior to implementation of regulations, or it could be done while these regulations are being implemented. A combination of the two would be a good indicator of the effect regulations of alcohol consumption will have on the carrying capacity of the resource.

Other studies have shown that urination in and around the river may be a problem in terms of additional nutrient loading. However, the Colorado River Management Plan instructs recreational visitors to urinate in the river instead of on the banks, because the river has a greater ability to dissipate the urine than the land does due to the nature of flowing water. Controlling urination in and around the resource will be difficult to accomplish. Questioning users about this practice will probably not lead to any significant findings due to the nature of the subject matter.

Conclusions

The following conclusions are possible based upon the case study design and on public hearings concerning the Illinois River.

Management and policy decisions must follow a clearly described plan of action in order to determine carrying capacity of any kind. Shelby and Heberlein (1986) state three prerequisite conditions necessary to establish social carrying capacity: 1) There must be a

known relationship between use level or other management parameters and social impacts; 2) there must be agreement among relevant groups about the type of recreation experience to be provided; and 3) there must be agreement among relevant groups about appropriate levels of social impact.

Condition one refers to a descriptive component: how management parameters are related to impacts. This is done by showing a relationship of how visitors' experiences change as the number of visitors or the types of use change. Generalization from one setting to another is not supported even when the settings seem similar. (Graefe, Vaske, & Kuss, 1984). Therefore, each setting must be measured based on individual indicators appropriate to the resource.

Condition two deals with resolving use conflicts prior to determining carrying capacity. "Lack of agreement about management objectives and the value judgments they reflect is the primary reason for difficulty in establishing capacities" (Shelby & Heberlein, 1986).

Condition three refers to specific evaluative standards. Shelby and Heberlein (1986) suggest that since the experiences to be provided are resolved in condition two, the relevant groups for determining evaluative standards will most likely be user groups. It is important to recognize that individual values may differ, but evaluative standards can be reached by recognizing the consensus as well as the differences. In contrast to the recreational visitor, persons who live in the immediate vicinity of the Illinois River have a stake in the quality and use of the resource. These people could be referred to as stakeholders in the river. They have values and evaluative standards associated with the Illinois River, and could provide an initial base from which to determine carrying capacity.

Other studies have shown that residents typically hold very different values from the recreational visitor. Residents tend to be more sensitive to change caused over time and to an irritation brought on by sociological contrast with the visitor (Mathieson and Wall, 1982).

Any type of capacity measurements require careful planning and attention to detail in order to be of use to both the managing agency and the visitors. Investing time and a little money at the outset of a project will produce returns many times over the initial investment cost.

Zoning is a viable method at some resources. The Illinois River currently has some zoning in the plan. Further zoning for use density will be very difficult due to the number of public access points to the river. Current management staff could not effectively patrol the different zones.

Measures of perceptions of crowding are applicable to the current user. Identifying previous users of the resource could assist in determining reasons for nonuse now. This type of survey would be difficult to conduct due to the constraints on the sample. A longitudinal study of current users willing to participate in future research could provide insight into perceptions of crowding and use of the Illinois River. This type of study could also measure overall satisfaction with the resource, vendors and management. Construction of an instrument to measure these items could be another complete thesis or dissertation at a later time.

Limits of Acceptable Change, the Recreation Opportunity Spectrum and the Visitor Experience and Resource Protection schemes combine many of the previously discussed methodologies. Some form of these plans is appropriate in determining the carrying capacities of the Illinois River, because they all require that management goals and objectives be defined prior to determining capacities.

Recommendations

The following recommendations are based on the conclusions in this study.

The Oklahoma Scenic Rivers Commission needs to define the management goals and objectives for the Illinois River and its tributaries. The goals and objectives should be specific enough to create indicators that measure impacts to both the visitor and the

resource. The Oklahoma Scenic Rivers Commission should determine the acceptable levels of water quality and apply the effects of changes in water quality to the recreation uses. The site managers should create an action plan that mitigates problems and addresses changes in recreational use and water quality. The site managers should develop time frames for measuring impacts and follow those guidelines. Site management and the Oklahoma Scenic Rivers Commission should reevaluate the goals and objectives as the nature of the resource and the characteristics of the visitor change.

The Oklahoma Scenic Rivers Commission should examine the various management strategies and their effect on important nonrecreational values. The Commission should also determine techniques appropriate for offsetting the effects of heavy use. The Oklahoma Scenic Rivers Commission should work with other state departments, such as the Oklahoma Tourism and Recreation Department and the Department of Environmental Quality, to develop studies that coordinate management of specific resources with other areas. As the management agency, the Oklahoma Scenic Rivers Commission must serve as the ambassador of the "public good" in the Illinois River watershed. While scientific evidence is desirable for each decisions, some management decisions must be made in good conscience based on value judgments.

Examination of the economic impacts of more recreation use as opposed to other impacts that may affect the water quality of the Illinois River need to be evaluated. The economic value of the TMDP water quality measurement system may be of great economic value to the few users who think they need permits to put their effluent into the river. But when compared to level of money generated by other economically viable industries, such as tourism and recreation, the value of TMDP diminishes, due to the effect that the water quality program may have on the Illinois River. Since TMDP allows the unused allocations for effluent to be sold to other users, the value of the available total dissolved particles becomes relevant to only those few that have property rights and access to the river. This system may benefit a few select individuals, but the quality of the

resource is not being improved by the addition of more dissolved particles. Who sets the limit for TMDP? Why add more effluent to the river when studies like these are being conducted to improve the quality of the resource? If the Illinois River is being managed as a public good, why permit the interests of a few private individuals to be placed above the public interest? The river ceases to be a public good when the interests of private parties are given primacy.

The Oklahoma Scenic Rivers Commission has the ability to be trend setters in terms of property management. By utilizing their established and duly authorized legislated control, the Scenic Rivers Commission can be innovative in areas that they manage. Some controls currently exercised by the Commission include prohibition of glass containers on the river, permit requirements to float the river and issuance of fines for littering. The property owned and managed by the Oklahoma Scenic Rivers Commission could be exemplars to illustrate the types of property management desired from the private property owners along the Illinois River and its tributaries. This innovative and exemplary management policy will demonstrate a public good conscience to private landowners and outfitters.

The Oklahoma Scenic Rivers Commission may wish to consider policies related to the following activities. Each policy and each activity are components of recreational carrying capacity.

1) Prohibition or limitation of camping on sensitive properties.

2) Prohibition of the use of alcohol on Commission properties.

3) Prohibition of the sale of alcohol within the river.

4) Enforcement of water quality regulations related to gray water dumping in campgrounds.

5) Implement a pack in - pack out policy for all visitors using the Illinois River.

6) The Scenic Rivers Commission could also close their access points

types of management actions impact users during different segments of their experiences. Studies that examine the natural resource, social and managerial perspectives as a whole would be of beneficial use to managing agencies as well as adding to the theoretical knowledge base that currently exists.

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