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THE UNIVERSITY OF OKLAHOMA

GRADUATE COLLEGE

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A DISSERTATION

SUBMITTED TO THE GRADUATE FACULTY

in partial fulfillment of the requirements for the

degree of

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THE ECOLOGY OF OUTDOOR RECREATION

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CHAPTER I

INTRODUCTION

An Overview

Typically, research studies involving adverse interactions between man and his environment have focused on a specific environmental stress or class of contaminants such as studies of air or water pollution. Such efforts have provided valuable in-depth knowledge of the influences of specific environmental contaminants on man, plants, and other animal life. A deficiency of this approach has been the inability to control other variables that are operational such as the effects of other environmental problems, and the dynamic state of the interactions between man and the environment being studied. A method which has shown promise as an alternative approach is the ecological approach.

The science of ecology has been defined as a systematic body of theory related to the "household of nature" (1). This method has involved the study of a total system rather than a fragment of that system. The ecological approach has been utilized to study numerous problems within well-defined, limited environments rather than attempting to perform scientific inquiry on a large scale. Since environmental problems

occur in a dynamic state and involve adverse interactions between man and the physical environment, the ecological approach appears to provide a meaningful methodology for the study of such phenomena.

The outdoor recreational facility provides a logical site for the application of the ecological approach to environmental problems. There has been found a broad spectrum of environmental problems within the outdoor recreational setting including adverse effects on man and the natural environment. In addition, such facilities can easily be viewed as closed systems since their boundaries are well-defined.

The ecological approach is essential if the environmentalist is to provide a broad conceptual framework for research and planning in order to implement future activities to cope with outdoor recreation problems and provide a potential method for the study of environmental problems within other segments of society. Such an approach would integrate the disciplines of environmental health and outdoor recreation within the philosophy of a homeostatic or closed system approach.

Environmental Health and Recreation

The study of the interaction between man and his environment has provided the very essence of the public health movement in the United States. Disease influenced by environmental contamination has been a dominant theme for public

health theorists and practitioners. The relationship of cholera to contaminated water supplies was first described by Snow (2) in the 1850's. From this humble beginning the public health movement has made great strides in the improvement of societal well being through the elimination of environmental contamination. The backbone of such programs has been the discipline of Environmental Health. Environmental health specialists have been responsible for the protection of drinking water supplies, proper disposal of sewage and solid wastes, control of disease vectors of both animate and inanimate origin, provision of safe milk and food, and numerous other environmental contaminants and stresses on man. In fact, environmentalists have done such a good job in the United States in the control of disease and other environmental stress that the quality and quantity of life has been improved considerably. The most significant killer diseases such as typhoid and cholera have been virtually eradiacted in this country. Average life expectancy has doubled for Americans in less than a century and much of the credit must be given to practicing environmentalists.

The environmental health movement has provided another contribution of paramount importance. It has been the philosophies, expertise, and activities of environmental health and the conservation movement that have produced the environmental awareness of this decade. Even though these two environmental movements have different roots, the

ultimate aims have both been the protection of the environment.

The American conservation movement started with the Roosevelt conference of Governors in 1908. This was a conference based on overtones of economic consideration. The primary concern at this point was that national resources must be conserved before they are depleted. The greatest thrust at that time was provided to the conservation movement by Pischot and Muir. Gifford Pischot, a professional forester, was the leader of those interested in future economic concerns and John Muir (3) began to provide impetus to the fact that natural resources provided much more than economic benefits. Indeed he felt that the asthetic values of wilderness areas and wildlife could not be considered in economic terms.

Even though environmental health has made numerous contributions to American life, this field of endeavor has not fully transcended the practices and philosophies of a few decades ago, and the descendents of this movement have not kept pace with the active leadership provided by the conservationists. It is true that environmental health specialists were the first professionals to begin to cope with air pollution in Donora, Pennsylvania (4), and other early disasters and have been responsible for the most part for the study and control of air pollution. Environmentalists have been the forefront to face other environmental catastrophies such as pesticide contamination. But the environmentalist has failed

to provide active leadership in recent years in many important areas of environmental concern.

There are two apparent considerations in continuing to provide environmental leadership: first to further assist in relieving environmental stresses on man, and secondly, to start protecting the environment from man. In these instances environmentalists have taken both an antropocentric and passive view of environmental problems. The environment has been considered only from the effects on death and debilitation of man, with man viewed as something above nature. When called upon by the public to do so, environmentalists have manipulated the environment to make it more healthy, but have given little thought to adverse effects of man on the environment.

To date, environmental health has not been concerned with many pressing environmental hazards. In spite of the expertise contained within this discipline there has been a lack of involvement in the controversies involving protection of streams, forests, wildlife, parks, lakes and wilderness areas. For that matter, accidents, injuries from consumer products, outdoor recreation, and numerous other phenomena involving adverse interactions between man and environment need to be considered by environmentalists.

One of the most essential "environments" of man and animals has been the outdoor recreation environment--the parks, lakes, rivers, forests, and wilderness areas of this

country. The United States has approximately 65,200 public recreational areas covering about 490 million acres. In 1968, an estimated 4.4 billion visits were made to these areas (5). Expanding leisure time, increased urbanization and mobility of people, and a rising standard of living have made it possible for more people to seek and utilize recreation areas.

Outdoor recreation takes many forms today from organized sports, walking and bicycling to the more traditional concepts of returning to the land such as camping, fishing, hunting, boating, and hiking. Activities of the latter group reflect the traditional outdoor experiences. In essence, these activities have been a return to ancestral values, traditions and general activites.

Historically, the wilderness has provided a place to escape the tyranny of rulers or invaders, a place for landless men or a space for those tired of associating with fellow beings. This phenomenon can be cited as a primary purpose for the exploration and settling of North America by Europeans and subsequent foundation of the United States. The early settlers camped, hunted, fished, and boated by necessity to provide for their basic security needs of food and clothing. The trip into the mountains or up a stream for fish and wildlife was not only a basis for existance, but was a vital part of the migration into the vast areas of the west. The use of the outdoors by settlers can be described by Maslow's (6) need hierarchy to indicate the satisfaction of

the basic needs of security and self-presenvation. However, trends today would indicate that higher levels on the need hierarchy were met, even then, by outdoor activities. With the high standard of living today, man flocks to the outdoors in ever increasing numbers to meet something other than the needs for food and clothing. It is apparent that to commune with nature has been a necessary function of man. The outdoors appears to have provided as escape valve from the tyrannies of "civilization."

Unfortunately, population trends have not enabled man to continue to have this method of escape readily accessible. Man has been forced from the land to urban centers in ever-increasing numbers. In fact, it will not be too long, if the current trend continues, before 80 per cent of America's total population will be living on 1.5 per cent of the land (7). The crowded megapolises of this decade represent the anti-thesis of the immediate past.

Environmental Problems and Outdoor Recreation

During the 1950's, a new revolution began whose ramifications, at this time, are yet to be fully explained or understood. The American people turned to the great outdoors in ever-increasing numbers. State and national parks, lakes, sand dunes, forests, and mountain streams began to be ravished by the swarm of the masses. According to a 1962 report published by The Outdoor Recreation Resources Review Commission (8):

> Between 1952 and 1962, when our population increased 20 per cent (to 189 million), visits to state parks increased 113 per cent (to 289 million), visits to national parks increased 87 per cent (to 88 million), and visits to other Federal outdoor recreation areas increased 238 per cent (to 338 million).

This acceleration has been increasing at an even greater rate as reflected by over 400 million persons visiting state parks alone in 1970 (9). This represented a 38 per cent increase over the 289 million people visiting state parks during 1962.

The great problem of the city, from which people were escaping, was being recreated in the outdoor environment. The recreation environment was becoming overpopulated. Yellowstone, Yosemite, and other popular areas were infested with automobiles, recreation vehicles, motorcycles, campers, and people who created traffic jams, noise, air pollution, solid waste, crime, and generally destroyed the parks (10). Therefore, by escaping in mass from population problems, people were recreating them in the outdoors.

Not only has the outdoor environment been devastated by the people, but the people have been killed and injured by the recreation environment and their fellow recreators. In 1969, there were reported about 200 fatalities and over 4000 injuries requiring medical attention in national parks alone (11). During the same year, there were 5900 deaths reported nationally from water recreation accidents (12). There has been no reporting of total deaths or injuries related to outdoor recreation activities; however, these few statistics

indicate that the hazard to human life at outdoor recreational facilities has been very severe.

To date, there has been little input into the recreation phenomenon by professional environmentalists. There is little information on the occurrence of disease in these areas. Furthermore, studies have been limited regarding the effects of man on the recreation environment in general. Time (13) recently quoted George Hartzog, director of the National Park Service, who stated:

> The practical problem is that we know exactly how many elk a park can handle ecologically, but not how many people. I have said no more physical facilities until I find out the answer.

Wildlife management could certainly provide a pattern for studying the recreation environment. In that field there have been professional wildlife biologists who have analyzed the interactions between wildlife and their habitat and have managed the herds and/or habitat accordingly. Outdoor recreational facilities (particularly lakes) have been designed for other purposes by engineers and politicians with little or no initial thought to their use by people or wildlife. The Corps of Engineers and other such organizations frequently have built dams for the primary purpose of flood control or to provide hydroelectric power with little thought being given to effects on the environment or the users of such facilities. Dam building activities bring into view another significant environmental consideration--the destruction of the environment

by providing recreation facilities. Even though recreation has infrequently been a consideration for the justification of water-oriented facilities in the past, more emphasis has been placed on this parameter in recent years. The engineering mentality has sought to use recreation for the justification of dam building projects. As Marine (14) has eloquently stated:

> ...there is, in America, such a thing as an "engineering mentality." There is an engineer's way of looking at problems, an engineering approach to public questions, to planning, even to correcting the malfunctions that were introduced by engineers in the first place. It is the simple supposedly pragmatic approach of taking the problem as given, ignoring or ruthlessly excluding questions of side effects, working out "solutions" that meet only the simplest definitions of the problem. It is an approach that never seeks out a larger context, that resents the raising of issues it regards as extraneous to the engineering problem involved.

The engineering mentality has not been an exclusive possession of the U.S. Army Corps of Engineers. It has been shared by the technocrats of industry and government who have continued to pollute the environment while assuring the public that they would develop the technology to "clean up" the environment. This mentality has been an "attribute" of other agencies such as the Bureau of Reclamation and the Soil Conservation Service and above all of politicians.

The engineering mentality has dictated that a dam be built because there was a river (or a river with just a few dams of it). In the case of the politician, a dam was built because there was a river in his District of State. This

philosophy has dictated the encouragement of flood plain development thus justifying flood control. It has meant the clear-cutting of national forests to boost the profits of lumber and paper interests with little thought to side effects or offering local natural resources to industry on a platter, along with tax incentives. The engineering mentality (Soil Conservation Service branch) has destroyed streams through channelization or "improvement" by straightening them and denuding the banks of foliage. The "justification" for channelization has been to put more land into agricultural production at a time when farmers were subsidized to take land out of production.

On the other extreme have been those "novice ecologists" who would leave the outdoors untouched by human hands. They would prohibit hunting, fishing and camping. These preservationists would not allow wildlife management or management of the recreational system because all outdoor resources would be "off limits" from the population.

There must be a central ground, whereby the outdoors can be preserved but not locked up, and utilized without being destroyed. It is this middle area where environmentalists can provide the public with reason and some measure of objectivity.

Outdoor Recreation Research

Studies of the recreational environment to date have primarily centered around the evaluation of single components of the recreation system. Fragmented studies of user characteristics or facility design have been most common with other single item endeavors conducted on economics, user demand, or management. Few studies have presented a comprehensive analysis of outdoor recreation with a view toward evaluating adverse effects on man and analysis of environmental problems. In addition, the awareness of the recreational facility user to existing problems has not been adequately determined within the context of environmental stresses. The utilization of a systematic, in-depth approach for the study of these factors appears promising and the ecological method provides such an analytical concept.

CHAPTER II

LITERATURE REVIEW

Ecology and Outdoor Recreation

An historical description of the science of Ecology might well start with the theories of Elton (15) or prior to his writings; however, for philosophies that are readily applicable to American outdoor recreation, the genius of Aldo Leopold provides a valid beginning. It was he who was one of the first to recognize that the "whole" and the interrelationships of the parts must be considered when dealing with a dynamic system. Leopold (16) provided the fundamental theory for wildlife management utilizing ecological considerations of wildlife and habitat. Perhaps an even greater contribution was his struggle for a land ethic (17):

> When we see land as a community to which we belong, we may begin to use it with love and respect. There is no other way for land to survive the impact of mechanized man, nor for us to reap from it the aesthetic harvest it is capable, under science, of contributing to culture.
>
> That land is a community is the basic concept of ecology, but that land is to be loved and respected is an extension of ethics. That land yields a cultural harvest is a fact long known, but latterally often forgotten.

Leopold effectively demonstrated that wildlife are dependent upon their habitat and that the habitat depends upon population dynamics. Shantz and Marbut (18) also cut through the specialization of plant and biologic ecologists before them by considering ecology in a broader context. In fact, they were the beginning of a movement to consider human ecology as a viable force in environmental influences.

The outdoor recreation "user" might well be considered in the same vein as the elk, deer or fish, as a part of the habitat. His actions might destroy the environment when the population becomes too large or he may be destroyed by it or other users within the system. When ecology is viewed as the scientific study of a dynamic system, it is readily apparent that this philosophy or approach is not only valid for plant or biologic life and wildlife management, but for broader application. An ecological approach can be utilized to study the world, a nation, a region, a state, or a state park. It is a generic concept which enables the integration of influences rather than a simplistic analysis based only on economics, political expediency, or popular attitudes. An ecological view can change popular attitudes and subsequently political action by providing a basis for outdoor recreation decisions that are based on some measure of objectivity rather than merely effective political power exercised by special interest groups. Decisions involving outdoor recreation or natural resources are necessarily

environmental decisions, since outdoor recreation deals with a substantial portion of the environment. Caldwell (19) has stated that:

> Involved in public decision making regarding natural resources and the environment are two intellectual tendencies or viewpoints that, although not necessarily opposites, are distinctly dissimilar. First of these is the "market" view. It sees the relatively free play of economic forces as the "best" determinant of environmental change. The second viewpoint is "ecological" and sees the natural world, including man and his work, as dependent for well-being and ultimate survival on the maintenance of an equilibrium or balance among the elements of the environment.

The "market" or economic viewpoint is best exemplified by the Corps of Engineers and the justifications used by this agency for the building of dams and dredging of bays in America. The cost - benefit ratio has been the basic tool for the justification of the building of their great structures of concrete and reinforcing steel. The dam-building projects have been essentially devoid of a broad context for analysis. As a result the justification and authorization of most of these projects has been dictated primarily by political expediency and the self-serving activities of the advocates of such projects. As a result of the nature of dam justification, many important environmental considerations have been deleted. Most important of these has been the effect of such projects on the environment in terms of siltation, destruction of wildlife habitat, drowning of unique or historic terrain, or even planning of the region involved. Secondly, there has been little or no initial planning for the safety of the

structure or the lake facilities. If an individual builds a swimming pool in his back yard, he must take special precaution that he has not created an attractive nuisance for his neighbors. The Corps of Engineers and Bureau of Reclamation have built attractive nuisances throughout America with no measure of caution for recreation safety. In most cases it has been incumbent upon local authorities to provide for the recreational management of facilities, which have no safety planning built into their design or function.

With the advent of the National Environmental Policy Act of 1969 (20), there was for the first time mandatory requirements for considering the environmental impact of dam-building. Therefore, there now is a mandate for considering factors other than the economics of a construction project. There are now provisions for dealing with the aesthetic qualities of the area under consideration. Provisions for the consideration of the safety of the recreator remain an area of great concern and merits the immediate attention of the public as well as public agencies.

Dam building and the resulting lakes have provided playgrounds for Americans and at the same time have provided habitat for fish, water for boating and other water sports and focal points for the construction of parks and recreation areas. These water-based recreation resources have primarily been a by-product of "flood prevention" or the generation of hydroelectric power, but they have created a large measure

of the outdoor recreational demand. Major consideration must be given to the methods used for the justification, design and construction of these facilities which have excluded the needs and desires of the outdoor recreational public and implications of environmental impact. Further, the management of such facilities has excluded these same factors after they were opened to the public.

The preservationist has found his justification in a corruption or simplistic view of ecology. The ecology of preservation reverts to the early foundations of the science when man was not considered a part of the ecological system. The preservationist can be as myopic as the engineer. One simplistic example involves wildlife. Many preservationists would eliminate hunting in North America, which would remove the most crucial tool of wildlife management. Not only would game become overpopulated, but the source of almost all wildlife management funds would be eliminated.

This is not to say that some areas should not be preserved in their natural state or that some dams should not have been built, but that there are more parameters to be considered than absolute wilderness designation or economic consideration of outdoor resources. The problem has been one of segmental thinking, segmental decision making--the "practical" approach to practical problems which has again and again produced some very unpractical results (21).

An adequate analysis of a recreational environment must be addressed toward disbalances of this ecosystem. Such disbalances might be exemplified by erosion of the soil, pollution of water, destruction of foliage, crime, a drowning, or any number of serious recreational problems. In a wilderness area this might be exemplified by overpopulation of a game species due to the absence of a natural enemy. Environmental problems in recreational areas might well be viewed as symptoms of a disease or diseases affecting this ecosystem. In medicine, symptoms provide a warning device in order that man might know that he is ill and can seek medical care. Typically, the entire body (system) is evaluated and the interrelationship of components is studied. Studies of such phenomena enable health authorities to design preventive programs to eliminate the disease from the population.

Environmental problems in recreational areas provide negative feedback which indicate that the ecosystem is in a state of disequilibrium (ill). If the malady is to be placed in proper perspective, there must (as in medicine) be an evaluation of the entire system to determine the nature of the problem. Adequate studies can then provide planning information which will enable administrators to prevent such problems in other recreation facilities.

It is readily apparent that the study of a recreational environment utilizing the ecological method must be limited to some extent so that observations can be useful.

However, the major methodological danger in ecological investigations is that of limitation or restrictiveness in scope (22). Buckley (23) has presented the concepts of "levels of analysis" to study the community. These levels, although utilized for systems analysis on a community level, are pertinent to an ecological approach to the outdoor recreation setting. These four general levels of analysis have included the physical, biological, psychological and sociocultural to provide disciplines with similar conceptual or methodological tools. Much of this information is currently available about a specific park or other recreational area. A physical description of the facility is usually available. Biologic information can be obtained from numerous sources ranging from wildlife studies by fish and wildlife departments to information on bacteriological water quality from state departments of health. A missing component has been the behavioral data on the users of such facilities and the collection of behavioral and attitudinal information should be performed by the researcher. On a grand scale a recreational environment might be studied utilizing a number of disciplines within each level of analysis such as engineer, economist, wildlife biologist, psychologist, urban planner, health planner, etc. However, on a practical level it is more desirable to draw upon existing agencies and information available from them. By utilizing the methods of these disciplines, additional information may be obtained for a research

endeavor. This can be accomplished by one researcher, utilizing existing information, using broad conceptual techniques to acquire additional information, utilizing a system or ecological approach for analysis.

Each level of analysis should involve an in-depth study of the multiplicity of factors involved. Primary emphasis must be placed on the social-cultural aspects of the facility user, since the ultimate solution of conflicts lie with the willingness of the user to support positive action.

The interacting influences of the physical, biological and social systems can come together in a holistic analysis utilizing the ecological approach. "Man in nature" can be evaluated by studying the parameters of specific symptoms of disequilibrium occuring among America's outdoor recreation resources.

Outdoor Recreation Resources

The recreation environment constitutes much more than land, it is all the components of the natural and man-made systems in America. It is the wilderness areas, rivers, lakes, state parks, national forests, national parks, and numerous other areas. In the 50 states and Puerto Rico there is a total land area of 2.27 billion acres of which 0.87 billion or 38 per cent is owned by state and national governments (24). Therefore, well over one-third of the total land area still belongs to all the people of the United States at the

present time. Much of this land and resources is available for outdoor recreation.

Public Lands

The 450 million acres of public domain in 10 western states, which is administered by the Bureau of Land Management, comprises twenty per cent of America's land (25).

In addition to the public lands under the jurisdiction of the Department of Interior, approximately 47 million acres of public domain are administered by other Federal departments and agencies (26). Much of the opportunity for meeting future needs for outdoor recreation in the Western third of the Nation and in Alaska rests upon these lands. Some of the most spectacular desert scenery and rugged mountain and canyon country in the United States are found on these lands. There is a variety of wildlife, fish, and habitat within the public domain.

Unfortunately, their use at present for outdoor recreation and for maintaining wildlife populations is restricted by prior demands by special interests groups. The public domain is being used for grazing, mining and water impoundments by ranchers, mining companies and the large power production interests for their own economic gain. Grasslands are overgrazed, minerals are extracted in the most rapid and economical fashion and the environment is destroyed to the detriment of wildlife habitat and unique scenic characteristics. Even the public (the owner) is excluded at times by

these groups when attempting to hunt, fish, and camp on public lands (27).

Millions of people are using the public lands for camping, hunting, fishing, and related activities, but as recently as 1962 in most states relatively little was being done to provide for orderly recreation use or to provide for access for the public (26).

A potential use of these lands is provided in the Recreation and Public Purposes Act (as amended) (28), which makes provisions for the conveyance of public demain to state and local governments for recreation purposes. This is one mechanism whereby the lands can be pulled from the grasp of special interests groups, but there are potential dangers to be considered in such conveyances since these governments can be as destructive as the private groups. Regardless of the managing agency, immediate attention must be focused on protecting these lands from environmental deterioration.

National Parks

The National park system covers 29.5 million acres and ranges from Alaska to Puerto Rico. It traces its origin to March 1, 1872, when President Grant signed an act creating Yellowstone National Park (29).

The Yellowstone Park act set aside a large wild area to protect the natural wonders it contains from private gain and to assure "their retention in their natural condition"

(29). The National Parks now include 278 areas with 73 natural areas, 170 historical areas, 34 recreational areas and the National Capital Parks. The National Parks are subject to perhaps 300 million visits a year by recreators. The results have been: overcrowding, sanitation problems, drownings, theft, drug abuse, destruction of parks, and numerous other problems (30). Starnes (31) has recently pointed out that the nation's overburdened National Park and National Forest systems are being destroyed each day by the novice outdoorsman. These individuals have depleted resources that have been protected for generations by true outdoorsmen and dedicated public officials. This author cited a recent report by the Conservation Foundation which demands "an immediate moratorium on roadbuilding, parking lots and other auto-oriented improvements within the park system." There is little question that the automobile and other motorized vehicles have played a major role in assisting the vandal in gaining access to the remote scenic wonders of the National Parks. It has been suggested that if you "take their hard roads and foam rubber padded vehicles away from them and they'll all join bowling leagues, which is a dandy place for them" (31). If the original intent of establishing National Parks is to be followed, they cannot be all things to all people.

National Forests

National forests generally cover larger areas than National Parks and have a more varied use. The right of the

President to reserve forest lands so they could not be disposed of within the public domain was established in 1891. Much of the credit for the large-scale reservation of federal forests must be given to Gifford Pinchot, a young forester working under President Theodore Roosevelt (32). It is interesting that almost 100 years ago a conflict which in time may become one of the greatest of environmental battles began over National Forests. Pinchot was attacked bitterly in his day by Westerners who wanted no national control of forest resources and he was berated by Eastern preservationists because, as a utilitarian, he expected the resources of national forests would be useful for economic purposes. Westerners wanted no control and Eastern preservationists wanted no use (32). This battle has raged throughout most of this century. There is now a third concern, that of recreational use of National Forests.

Each year lumber companies cut billions of feet of National Forest trees. In addition hundreds of thousands of hunters and fishermen, tens of millions of campers, picnickers, vacationers, hikers and skiiers use the National Forests for recreation purposes. There have been other uses such as mining and cattle grazing. Perhaps one of the most critical of all conflicts has been the disputes over "inholdings within the forests." It has been estimated that of the 186,000,000 acres within the National Forests, about 40,000,000 acres or 22 per cent of the total acres are leased or controlled by

special interests at this time (33). There have been numerous disputes involving boundaries, road maintenance and admission of the recreational public into the forests.

There should be little difficulty in use of National Forests for recreational purposes since they belong to all the people of the United States, but they have been controlled both directly and indirectly through the United States Forestry Service by lumber, mining and grazing concerns and other special interest groups. The basic conflict resulted from the policy of the United States regarding use of National Forests. This policy was "multiple use," which has been defined by the Congress as (33):

> ...the management of all the various renewable surface resources of the National Forests so that they are utilized in the combination that will best meet the needs of the American people; making the most judicious use of the land for some or all of these related resources or services over areas large enough to provide sufficient latitude for possible adjustment in use to conform to changing needs and conditions; that some land will be used for less than all the resources; and harmonious and coordinated management of the various resources, each with the other, without impairment of the productivity of the land with consideration being given to the relative values of the various resources, and not necessarily the combination of uses that will give the greatest return or the greatest unit output.

The greatest problem rests in the fact that there have never been renewable resources in the National Forests. They were only renewable in the eyes of the "Big Three" of Western business--the lumber, grazing and mining interests. Perhaps too they were renewable to those recreators who destroyed the environment when they used the forests by chopping

trees and depositing their trash upon the countryside. The use of the National Forests by the Big three has been based on the premise that resources such as trees, minerals, and grass are renewable. On a limited basis, some of the resources might be considered in this fashion and used to meet national demands but none are really renewable. Certainly, some of the resources could be used but not by the "rape and run" techniques employed by these groups. Examples of this mentality have been expressed in the indiscriminate clear-cutting of trees, strip mining of minerals and overgrazing of grasses which have been common practices. Today, such practices must be stopped if the forests are really to "meet the needs of the American people."

The use of the National Forests for recreation purposes has been increasing at a phenomenal rate. Total visits per year have increased from 5.6 million in 1925 to 135 million in 1965. About 70 per cent of all public lands used for recreation in 1963 were within the National Forests (8). There is destined a collision course between preservationists, recreators, and the "Big Three" over the use of National Forests.

Water Resources

About one-fourth of all outdoor recreation has been dependent on water. Participation in swimming, fishing, boating, water skiing, and ice skating accounted for 2.8 billion activity days in 1965 and has been projected to increase to

over 7 billion during the year 2000. Water resources enhance the recreation experience afforded by such outdoor activities as camping and picnicing and two-thirds of all designated public recreation areas either have a body of water within their boundaries or are adjacent to accessible water (24).

In 1965, there were 41 billion acres of water surface in the lakes of the United States or about 0.21 acres per capita available for recreation purposes. The per capita distribution ranged from 0.05 acres in the middle Atlantic (NY, PA, NJ) section of the country to 0.69 acres in the mountain region (Montana, Idaho, Wyoming, Nevada, Utah, Colorado, Arixona and New Mexico). In addition, the great lakes and ocean shorelines provided a recreation shoreline of about 22,000 miles or 0.60 linear feet per capita (24).

There were an estimated 3 million miles of streams in the United States. Of this total only 725 streams with a total length of 100,000 miles have a minimum flow of 550 cfs or more. There has been a growing interest in preserving some rivers in their free flowing state and rivers of 550 cfs and more are considered as potential candidates for the Wild and Scenic Rivers designation (34). There have been continuous struggles between dam-builders, recreators and preservationists in the battle toward future use of these streams not to mention the effects of municipal and industrial pollution of most of the nation's streams. From the standpoint of the recreator and the general public, the future availability

and quality of water-oriented recreation facilities have been left very much in doubt.

State Parks

The states have also been in the act of providing parks and recreation areas for their people. By 1967, there were 3,337 areas in the state park and recreation systems, covering over 8.5 million acres (35). In 1970, there were approximately 474 million visits to state parks of which about 50 million were overnight stays.

Though little has been written on the subject to date, it is reasonable to assume that state parks will experience the same problems of overpopulation, crime, deaths and environmental contamination as the National Parks. In fact, they are perhaps more susceptible since state parks are more accessible and more subject to local political pressures.

There are numerous other outdoor facilities that might be considered in a review of the available outdoor resources, but for the traditional outdoor experience the majority of the public must utilize national parks, national forests, lakes, rivers or streams, or the state parks. These facilities serve the greatest numbers of recreators and are subject to the greatest demands by other groups. It is these facilities that are on the line and form the battlefront for environmental concerns, economic exploitation and the future of traditional outdoor recreation activities.

Outdoor Activities

Hunting

Man has always been a hunter. In the beginning, man hunted for food and clothing and it was part of the process of survival. Man domesticated many animals to provide for a portion of his subsistance and improved his weapons. But hunting remained a necessity for survival through the 19th and portions of the 20th centuries. The westward push was not just to discover and settle new lands but also to follow the great game herds. The needs of hunting changed during the 1800's and man's greed took over--he turned to game as a source of profit (36).

Buffalo were slaughtered by the thousands for their tongues and were reduced from millions to the point of practical extinction by 1884. Farmers and cattlemen plundered the habitat of buffalo, elk, antelope, and other animals with the plow and demands by domesticated animals. The great fur companies were involved for many years in the systematic collection of game species for their fur. John Jacob Astor became the richest man in America because he know how to organize the extermination of the beaver (37). With no constraints on bag limit, market hunters systematically eliminated water fowl for profit. The great game herds were being decimated by trapper, sheep herder, farmer, and cattlemen alike.

Legitimate sportsmen began to recognize that if actions were not taken to curb the wanton destruction of wild birds

and animals for profit, they would become extinct. The concerns of hunters and conservationists began to be translated into action.

In 1894 Representative John Lacey of Iowa carried through the Congress an act for protection of wild animals in Yellowstone Park. In 1900, Representative Lacey sponsored an act to prohibit interstate shipment of game illegally killed. In 1914, through the initiative of C. J. "Buffalo" Jones, Congress appropriated money to preserve buffalo to be kept in Yellowstone Park. In 1913 the Weeks-McLean bill was passed which provided protection for migratory game birds (38).

The development of wildlife management has resulted from the demands by hunters that hunting license fees be used to conserve game. Almost the entirety of existing game management programs, refuges and public hunting areas have been financed by hunters at their insistance. As the needs of hunting for food became less, the concept of saving game for sport and enjoyment by future generations began to grow.

When marsh drainage, drought and overshooting resulted in reductions in the water fowl population, sportsmen and conservationists pressured Congress for funds to help the birds, and in 1934 the Migratory Bird Hunting Stamp Act was passed. This required each hunter 16 or older to purchase a duck stamp, and such funds were used for wetlands acquisition and the development of the National Wildlife Refuge System (39).

Since 1934, hunters have poured 117 million dollars into water fowl preservation through the purchase of migratory water fowl hunting stamps.

The contributions to wildlife by hunters were augmented through two other major public sources:

a) the excise tax on sporting arms and ammunition provided by the Pittman-Robertson Act of 1937, and

b) the purchase of hunting licenses and permits.

These funding sources have accounted for 438 million and 1.6 billion dollars, respectively, over the years. These three major sources of funding for federal and state wildlife agencies have accounted for 2.2 billion dollars (40). In 1970, there were almost six million hunting license holders in the United States and expenditures for licenses and permits that year exceeded $108 million (41).

Contributions by individual hunters to Ducks Unlimited's effort to maintain Canada's wetlands have totaled $22 million since 1937. Contributions currently total $2.5 to 3 million per year. There is little doubt that, collectively, hunters, and their organizations, contribute $500 million a year toward wildlife conservation. This does not include some $2 billion hunters pour into the nation's economy in the form of equipment purchases and travel costs (41). Hunters then have provided for wildlife management, land acquisition and enjoyment of man.

Documented evidence of adverse effects on man while hunting has been limited to information about firearms accidents. There was reported over 1100 deaths and 6,000 injuries from firearms accidents while hunting during 1969 (12). There has been a definite need for documentation of other environmental hazards associated with this popular sport.

The enjoyment of hunting by man is not easily put to words. Gasset (42) expressed that:

> Life is a terrible conflict, a grandiose and attrocious confluence. Hunting submerges man deliberately in that formidable mystery (the hierarchy among living beings) and therefore contains something of religious rite and emotion in which homage is paid to what is devine, transcendent in the laws of nature.

Hunting is much more to man than the killing or the preservation of game. It is the lore, the love of wildlife, the practice of ancient methods, the study and observation of nature and many other things.

Fishing

Fishing is one of man's oldest pursuits. Even men of the stone age fashioned crude tackle to take fish for food. One of the earliest references in literature referring to fishing is the Old Testament, which reveals that fishing with a hook, as well as with nets, was a common practice of the times and that fish comprised an important staple of the diet (43).

Perhaps the most famous work on fishing was Izaak Walton's The Compleat Angler (44) available even today in the

text of the fifth edition, which was published in 1676. This book described the great joys of fishing three centuries ago. Fishing remains one of the most popular outdoor sports in America.

It has been estimated that about 30 per cent of the population, 12 years and older, fished during 1965. This represented over 42 million people (45).

Environmental changes have perhaps affected the fisherman as much as any other outdoor sportsman. Habitat for fish has been destroyed by water pollution and created by water impoundments. Through the building of dams, fishing opportunities have been created throughout America. But the dam building has also destroyed the fishing habitat and the fish. Salmon runs have been blocked and breeding grounds destroyed by dams. Free flowing streams have been stopped by dams and destroyed by channelization. Fishing opportunities have flourished for the lake fisherman and have been depleted for the "purist" fly fisherman who has seen the destruction of mountain streams. Meanwhile, agricultural, industrial and domestic pollution of streams has continued throughout the United States.

Boating

It was estimated that there were about 8 million recreational boats with about 40 million Americans engaged in pleasure boating in 1968 (46). Since 1962, there has been

an increase of approximately 160,000 new boats per year; therefore, if this rate of increase remained constant, there were 8.3 million boats and 41.5 recreational boaters in 1970.

Water provides a focal point for outdoor recreation and boats provide a mode of transportation to enhance the enjoyment of many activities. Without boats, methods for taking fish and wildlife would be limited and water skiing, trolling and other activities would not be possible. In addition, boating provides a source of enjoyment apart from other outdoor practices. Many people purchase boats simply for the sake of boating. This is true for sailboats, canoes, motorized craft and various small paddle boats. Based on a study conducted in 1958, projected figures would indicate that about 20.0 million people used motor boats for fishing, 17.8 million for pleasure cruising and 2.1 million for hunting water fowl during 1970 (46).

The Coast Guard (47) reported that during 1970 there were a total of 3803 boating accidents with 1,418 deaths and 780 injuries, but they readily admit that only a small percentage of all boating accidents were reported. The Coast Guard further reported that of the accidents where the operator was at fault, the 12 to 18 age group experienced three times the expected number of accidents. At that time only 14 of the states had enacted laws to exercise control over the operation of boats by this age group. At present, there are few controls in any state over the operation of boats by

persons of any age. Indeed in most states, the only qualification for operating a boat has been for a person to have the wherewithal to buy, rent, or borrow a boat. The need for regulation of boat operators is obvious in light of the number of deaths and injuries from boating accidents.

Water Skiing

Water skiing is a sport enjoyed by approximately 8 to 9 million persons per year at least one time per year. Of the many reasons why people buy outboard boats and motors, the third most mentioned purpose is water skiing and nearly 750,000 water skis are sold each year, a figure close to the number of new skiers entering the sport (48). When the elements of a speeding boat, water, and a person on water skis are combined, the results is a great potential for death or injury not only to the skier but to other users of the general area. Fortunately, in the 50 years that Americans have enjoyed water skiing, reported deaths and injuries in this sport have been few. It has been estimated that only about 10 persons per year die from accidents associated with water skiing (49). This has largely been true because the concentration of skiiers in recreation areas has not been great and common sense safety practices have been followed. However, there have been no adequate estimates of non-fatal injuries associated with this sport. As the density of users of water-based recreation facilities increases, the hazards associated with water skiing could become significantly greater.

Camping

Traditionally, camping has been a way of living, whereby the camper voluntarily removed himself from much of the interdependence of society. Other than for the gear and provisions he carried with him he was dependent entirely on himself or others in his small group. At the turn of the century, the mark of a skilled camper was the ability to live off the land for long periods with only his ingenuity and outdoor skills (50). Typically, camping was a means toward other activities such as hunting or fishing.

Today, almost all camping is done in the developed campsites of state and national parks and forests. The camper and his family infrequently "camp" in the opinion of many skilled outdoorsmen. They bring their household with them to a recreational area. Elaborate campers on pickups or camping trailers pulled behind their vehicles contain all the conveniences of home. Perhaps color television is more interesting when watched in a park or on the lake's shore. The new breed of camper has increased dramatically in numbers as reflected by a 35 per cent increase in campers from 1960 to 1965 (45). It is the novice camper of today who is having the greatest adverse effects on the recreational environment. Herein lies the greatest contributor to overpopulation of outdoor recreation facilities.

It has been said that on an average summer day Yosemite National Park contains three times the number of people

per square mile than does Los Angeles County (51). Most of them are novice campers recreating the problems of the overcrowded city from which they hope to escape in the outdoor environment.

Swimming

Swimming is one of the most popular outdoor recreation activities in America. In 1965, over 68 million people participated in this activity (45). Much of the swimming in the United States is done in swimming pools and pools were reported to number over 350,000 by 1962 (52). Control of environmental hazards associated with swimming pools has been good as reflected by a very low incidence of drownings and disease in such facilities. Swimming in lakes, coastal waters and rivers is another situation. The bulk of the 5900 water recreation deaths reported in the United States during 1969 occurred in these outdoor facilities (12). Even though few statistics are kept on disease contracted in water-based recreation facilities, there have been documented cases of a number of diseases. Contaminated coastal waters have been blamed for outbreaks of conjunctivitis, furuncles, laryngitis, otitis, rhinitis, ringworm, sinusitis, sore throat and tonsilitis, in addition to the various enteric infections, including typhoid (53).

Wagenet (54) has shown a direct relationship between an increased number of swimmers and a rise in fecal coliform

counts in a small lake. As the population of swimmers increases throughout America, this relationship would suggest an increased potential for contracting infectious diseases.

Picnicking

Over 80.5 million persons picnicked in 1965 and were involved in 451 million occasions of participation (45). Within the context of the facilities considered in this document, picnicking appears to be more of an ancillary activity rather than a primary purpose for utilizing the facility. While the facility user camps, hunts or fishes, he was often observed by researchers seated at a picnic table. Consequently, he was tabulated as picnicking and it is probable that the statistics for picnicking are inflated.

Evidence of disease related to picnicking has not been collected routinely by health authorities with specific reference to outdoor recreation; however, the literature has been replete with documentation of food borne disease contracted while picnicking. Food borne disease is usually classified into two classes: food intoxication and food infection. Sources of food intoxication include chemical (arsenic, cadmium, lead, nitrates), poisonous plants (rhubarb leaves, mistletoe berries), animal (clams, oysters) and the more common sources such as Botulism, Staphlococcus and Clostridium perfringens. Common food infections have been Salmonellosis and Bacillus cereus. The picnicker has been

subject to many of these diseases due to improper preparation and storage of food (55).

Other Activities

There are numerous other activities frequently participated in either independently or in conjunction with those previously mentioned. Some of the most important activities include: sightseeing, nature study, sun bathing, and hiking. Like picnicking and even camping, the activities have been frequently combined with other activities. Environmental hazards have been much the same for these activities since destruction of the physical and biological environment and hazards to the individual were operational.

Man's Attitudes Toward the Environment

> We travel together, passengers on a little spaceship, dependent on its vulnerable resources of air and soil; all committed for our safety to its security and peace; preserved from annihiliation only by the care, the work and I will say, the love we give our fragile craft.
>
> Adlai E. Stevenson
> July 9, 1965

Man has been a principal recipient of the outdoor recreational facilities he has also been the source of environmental problems. It has been man's relationship with the recreational system, natural and artificial, that has provided recreational experience and environmental disaster. Man's interactions within the total system must provide the basis for recreation research.

The design and/or management of recreational facilities has been political since most facilities have been controlled by public agencies. It is important that the wishes of the recreational public be heard since they will ultimately be translated into political action through elected representatives. The views of the public weighed against the knowledge of the existing recreational system are of paramount importance in facility evaluation. Central to this view are the ways in which man has viewed the land and his environment and the future attitudes as they regard the outdoor recreation environment. Of particular concern is the necessity for the transformation of attitudes toward the acceptance of a spaceship earth philosophy. The fact that resources are finite has not been a concept embraced by the masses. This is readily understandable when the history of man's relationship to his environment is examined.

The pilgrims and subsequent settlers in the new world perceived a place with unlimited land and resources there for the taking. Throughout the early history of the United States, settlers donned their coonskin caps and pushed West to conquer the wilderness with axe in hand. For three and one-half centuries, Americans have lived with the myth of unlimited resources and "open space." Indeed, most Americans still retain their coonskin cap philosophies. There are numerous examples of this philosophy today such as the national goal of an ever-increasing gross national product, efforts toward

increased industrialization by many state and local governments and the general belief perpetuated by Chambers of Commerce that "growth is good" for the community. The primary underlying component of environmental destruction today is the view that every man can do as he pleases with his land. Land misuse in the United States has been the base of the economy and the principal feature of environmental deterioration. It is interesting that the individuals and institutions that destroy the environment have frequently cited Jefferson's philosophies as the basis for their property right. However, many Jeffersonian scholars have contended that Jefferson and the other founding fathers never intended for individuals to own real property, but to use it in good faith and in the public interest (56). Garrett Hardin (57) re-emphasized this concept and argued for a new public morality in his classic paper, "The Tragedy of the Commons." He pointed out that all rights in society are determined by man and that no one has a "natural right" to do anything.

The landing of the Apollo spaceship on the moon in 1969 and the beaming of pictures of the earth back to the United States prompted Caldwell, Boulding and others to employ Stevenson's analogy of "spaceship earth" to explain the delicate balance that exists between man and his environment. Perhaps more importantly, it enabled man to understand, that like the astronauts, he lives in a homeostatic society (58). Thus, man begins to recognize that he lives in a finite world

with expanding population, economy, employment and expectations. He is faced with an increasing dependence upon artificial systems and their maintenance. These factors are not only true for the world, but for a country, a city or even an outdoor recreational system. Any of these natural or artificial systems may be viewed as finite areas or closed systems for evaluation and management. Indeed, all the resources on the earth must be viewed in this fashion. The politics, economics and management techniques of the past and present are now invalid because they are based on the myth of unlimited resources. There is the necessity for a new ideology, a theory of man and nature that leads to human behavior which is compatible with the fact that there is a limit to all resources.

Along with man's philosophy toward land and land use as a principle contributor to destruction of nature has been man's narrow view of the concept of environment. It appears that man's view of his environment at the present time is that he is somehow apart from the environment and that deterioration is either necessary or the fault of someone else.

Lynn White (59) has presented the view that the ecological crisis derives from Christian doctrines of human superiority to the world of nature. He has stated that these Christian attitudes are so deeply rooted within western civilization that nothing less than radical transformation of personal beliefs is required in order to prevent the environment from declining toward final oblivion.

Phillip Ritterbush (60) has stated that man's abuse of his environment seems almost vengeful, as though in retaliation against nature for some cosmic insult administered to the human race as a whole. However, he suggested that the attitudes of Francis of Assisi and of Albert Schweitzer indicated that the cultural and ethical traditions of the west were neither wholly or inherently hostile to an ecological view of nature. They have also indicated that in some men at least, inner aggressiveness can be sublimated or subdued. Dr. Schweitzer once wrote "the great fault of all ethics hitherto has been that they believe themselves to have to deal only with the relationship of man to man."

The view of the environment, that has predominated in western and especially American society, has been essentially economic. The world has been seen as a storehouse of natural resources, a God-given supermarket. Man's success in competition with other living species suggests that over the past millenia this attitude has had a positive survival value. But evidence that this anthropocentric attitude may have worked for man to date does not support the faith that it will necessarily continue to do so in the future (21).

Society is now transcending the period when man believed in himself and the work of his hands, had faith in the powers or reason and science, trusted his gods, and conceived his own capacity for growth as endless and his widening horizons limitless. Man in modern industrialized society is

rapidly becoming detached from the technology that has transformed his society and now threatens to destroy it (61).

Odum (62) has stated that the weakest link in pollution abatement strategy has been the inadequate legal protection of the environment and the consumer. The public must be properly informed in order that eventual legal protection can be initiated. The restructuring of popular attitudes in the light of scientific information thus becomes a major and continuing challenge.

Lynton Caldwell (21) defined a matrix of social-political behavior, through which environmental policy decisions are made, in which four factors or dimensions are definitive. These are the popular attitudes, political institutions, technical-economic feasibility, and time. The significance of these factors in relationship to environmental controls obviously depends upon their interactions. The key in evoking change in the American system is restructuring of popular attitudes to affect the judgment of political institutions.

Man in an integral part of the environment. Although the environment does not depend upon man for its functioning, man is the only animal capable of significantly modifying his ecosystem to conform with his desires. Man's desires then do constitute a force or working part of a thinking layer which modifies the total environment. Man's desires are in part dependent upon total concepts or how man views himself in

relationship to his environment which will significantly affect how he responds to it or in it.

Land and how man views it or responds to it shown to play a significant role in environmental deterioration. Outdoor recreation is for the most part totally dependent upon these same components: Man's values and traditions, land and other resources, and environmental deterioration.

Summary

There have been many examples of how man has destroyed the recreational environment, but little information about the adverse effects on man within this environment. About the only data available has been information about drownings, firearms accidents while hunting, and estimates of boating accidents.

There has been essentially no national or even local data that reflected the hazards to health or life in recreational areas. It has therefore been impossible to assess the extent to which recreational areas are safe and/or healthful for the user.

Outdoor recreational facilities then involve the following major areas for inquiry: the effects of man on his recreational environment, the effects of the recreational environment on man and the effects on the environment from construction of the artificial facilities initially. A fourth and perhaps more critical area is the analysis of the characteristics of the user and his opinions and attitudes toward his

recreational environment. A study of the interactions between these components is certainly the essence of a balanced recreation study.

CHAPTER III

PURPOSE AND SCOPE

It has been shown that there are massive environmental problems associated with increased participation in outdoor recreation. Limited data are available about specific problems, and there has been a significant lack of information about the total impact upon man and the environment within recreational facilities. This study was performed to develop and demonstrate the ecological approach to the study of environmental hazards. The primary thrust has been the study of the interacting influences of the physical, biological and social systems within a specific recreational facility. By bringing together physical and biological data from the multiplicity of agencies involved with the facility, together with the acquisition of data from the user, an overall analysis was performed.

The facility selected was Little River State Park, which contains Lake Thunderbird. The park is located approximately 13 miles east of Norman, Oklahoma, and consists of 4010 acres divided by the lake, which has a water surface of 6070 acres (63).

In 1971, Lake Thunderbird experienced the third largest population density of any water-oriented recreational facility in its classification (64). This lake ranked only below Lake Mead, Arizona, and Jackson Hole, Wyoming. The population and activities performed on Lake Thunderbird were essentially unregulated by authorities thereby providing a freedom for people to interact with this environment as they saw fit. This situation provided a natural laboratory for observing the behavior of man in his environment when the major limitations on behavior were the restraints enforced by his peers.

Within the scope of this study was a specific description of the natural and man-made facilities, and an analysis of the environmental problems in each area, thus providing an environmental impact analysis of the recreational facility. The next step was to study the nature of the user population, and the awareness of the user of environmental problems and environmental hazards with the park.

For the second phase of the study an in-depth interview of random users was conducted during a 6 month period in 1972 with four specific areas of inquiry: a) demographic data, b) injury and illness experience at the park, c) outdoor experiences at the park, and d) opinions and observations about the park.

The primary thrust of this study was development of techniques for the efficient study of the multiplicity of

factors involved in the outdoor recreational system with particular emphasis upon environmental problems. By ascertaining the awareness of the user of environmental deterioration, determining his injury and disease experience, and awareness of other problems it was felt that valuable information could be documented about the interactions between man and this environment. Obviously, the major benefits of such an approach resulted from evaluating such human data within the context of documented information about the natural and man-made facilities that were present. Thus, the ecological approach provided invaluable data for correction of problems and for the planning of outdoor recreation facilities in the future.

CHAPTER IV

MATERIALS AND METHODS

This study was made possible by cooperation from the Oklahoma Division of State Parks, Oklahoma State Wildlife Conservation Department, Oklahoma State Department of Public Safety, and the Oklahoma State Department of Health. These agencies and their personnel provided valuable information about Little River State Park, Lake Thunderbird, and the Little River Public Hunting Area, the facilities where this research was conducted.

Little River State Park was created in 1965 upon completion of Lake Thunderbird, which the park surrounds. At the time of this study, there were 4010 land acres of public access with land based recreational activities occurring on approximately one-fourth of these acres. Lake Thunderbird had a total shoreline of about 86 miles and a water surface of 6070 acres, all of which theoretically was available for recreational purposes (Figure 1). The two upper arms, Little River and Hog Creek, were included within the Little River Public Hunting Area and these hunting facilities totaled approximately 2400 acres. Little River State Park is composed of the remaining shoreline and has provisions

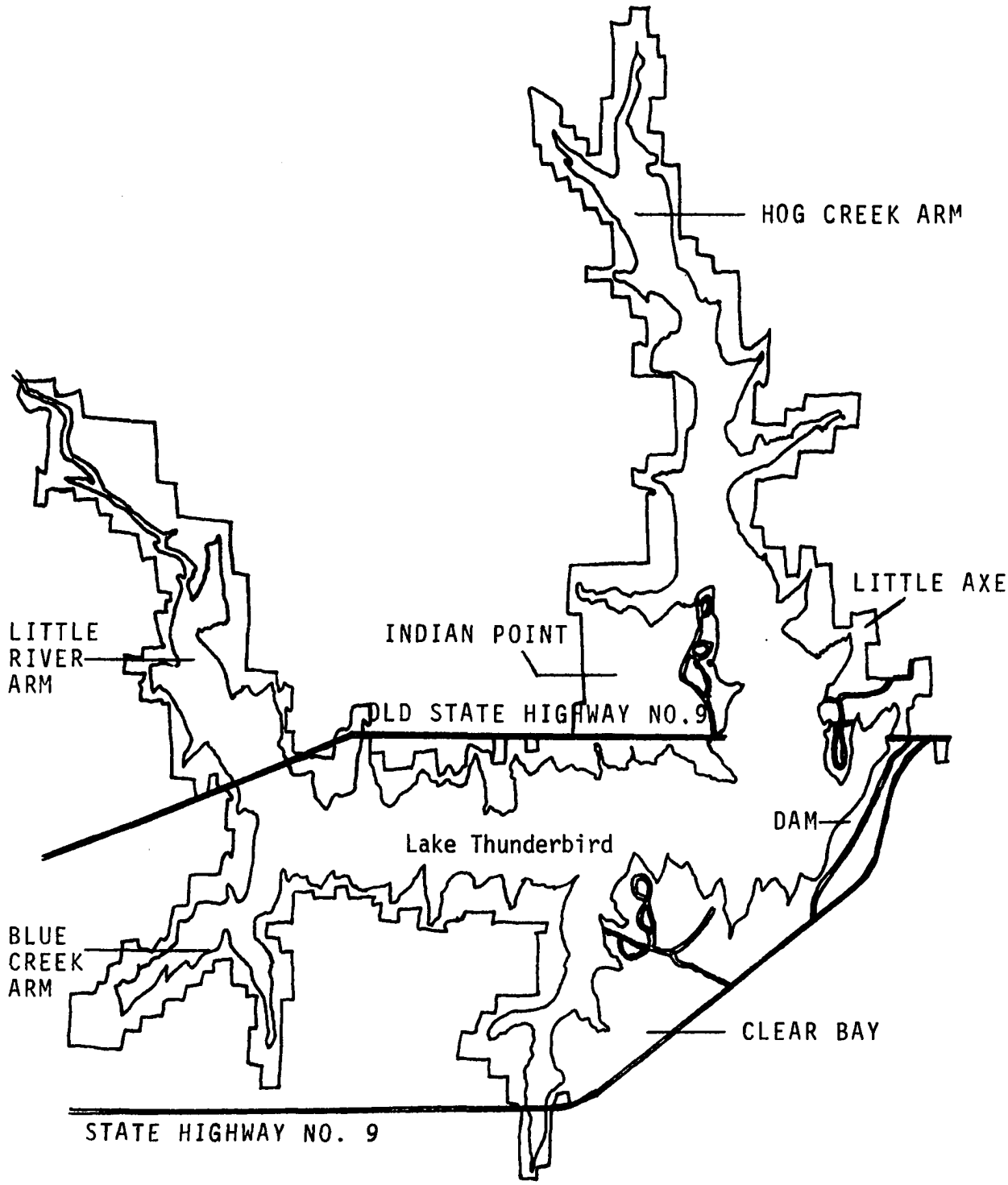

Figure 1 - Little River State Park

for camping, water sports, fishing, picnicking, horseback riding, and archery (63). All these facilities were included in this study and all were referred to as Lake Thunderbird, which is the common name for the total recreational facility.

In 1971, there was a total attendance of 2,300,000 and during 1972 1,511,000 visits were made between May 1 and September 5, 1972, the peak recreational season.

Phase 1 of this study involved the analysis of information about the natural and man-made facilities and the collection of environmental data. Much of this information was collected from the official agencies with responsibility for the facilities. Environmental evaluation also required some subjective evaluations by the author.

Phase 2 of the study involved in-depth interviews of the user population. The interviews were conducted in each land use area on a representative sample of the total population for that specific use area. There were four major use areas within the park: Area A, Area B, Little Axe Area and Clear Bay Area (Figure 2). Since specific population data were not available for these specific areas, several authorities, including the park superintendent and lake ranger, were asked to estimate the percentage of the total population utilizing each area. An estimated distribution was then derived which included: Area A, 10 per cent; Area B, 40 per cent; Little Axe, 25 per cent; Clear Bay, 15 per cent and 10 per cent for all other areas of the lake. This distribution was

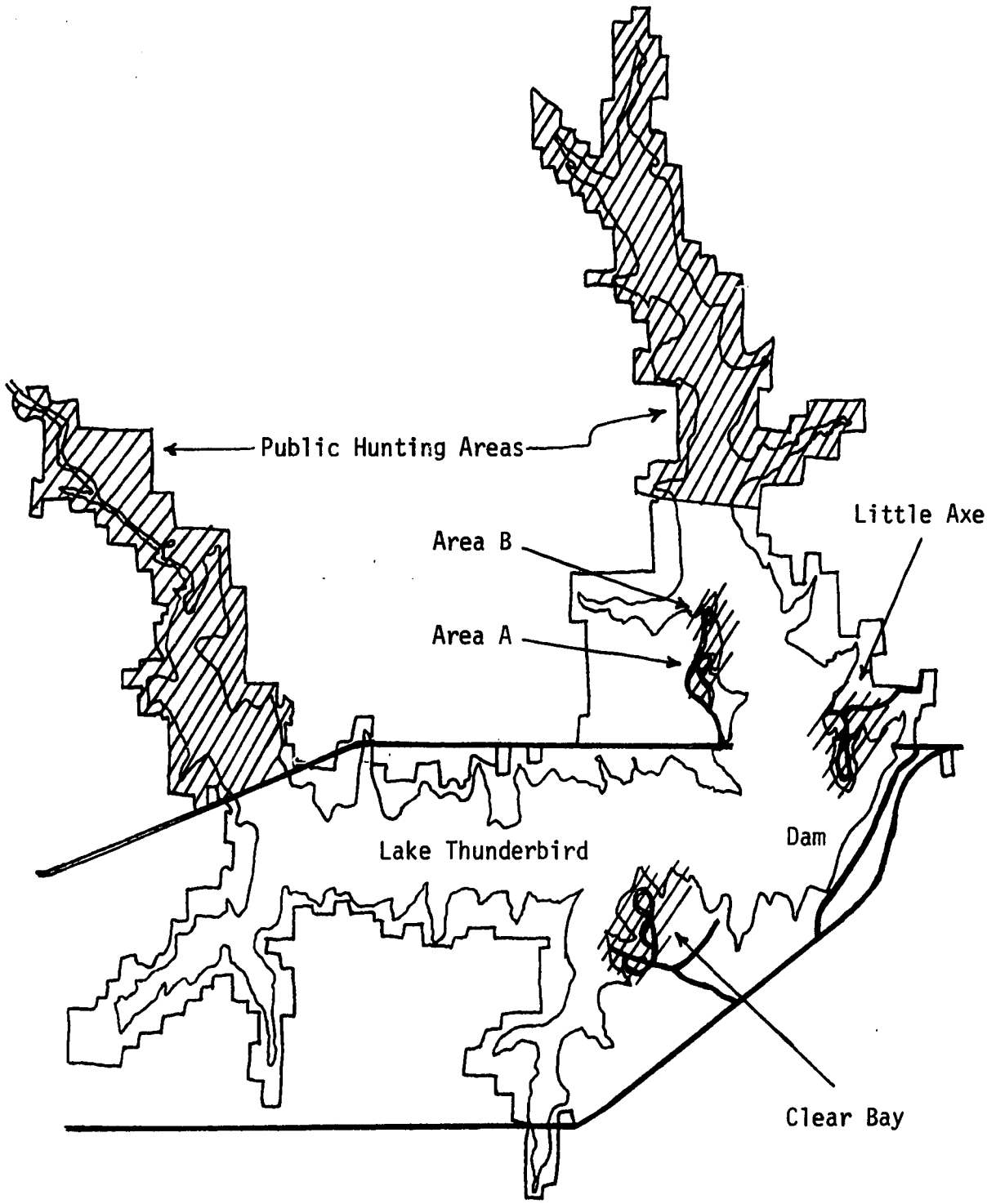

Figure 2 - Major Use Areas of Little River State Park

then applied to a potential interview population of 150 and the appropriate number of interviews were performed within each land use area of the lake.

The in-depth interview procedure included the use of a self-administered questionnaire (Appendix A), completed by the user with minimal assistance by the interviewer. Interviews were selected from July 1 through December 31, 1972, by randomly selecting users within the specific use areas. When the interviewer selected a group, they were addressed as a group and then one individual was asked to volunteer to complete the questionnaire. It was felt that the leader would come forth to perform this function. Only four of the 154 users contacted declined to take part in the study.

Upon completion of all 150 interviews, responses were analyzed and related to physical, biological and environmental data which had been previously collected.

CHAPTER V

OBSERVATIONS AND DISCUSSION

Natural and Man-Made Facilities

Lake Thunderbird, which is a small recreational facility located 13 miles east of Norman, Oklahoma, serves the central area of the state including Oklahoma City and a population of over 855,000 people. Recreational demand in this area has grown substantially and the availability of recreational facilities has been minimal due to the physical characteristics of this area of Oklahoma.

Physiographic Features and Structures

This area of the state is included in the Prairie Plains Homocline, which consists of a gently westward-dipping Pennsylvania and Permian rocks. The plain slopes eastward from a maximum elevation of 1,350 feet a few miles to the east of Lake Thunderbird. Over this distance the average slope is about 6.4 feet per mile. The topography in the general area is mature and well drained with about 50 per cent uplands, 40 per cent slopes and 10 per cent lowlands (65).

Stratigraphy. The rocks exposed in this general area comprise several thousand feet of Pennsylvanian and Permian

sandstones and shales with some limestones. The overlying mantle consists mainly of Pleistocene terraces and Holocene or Recent alluvium in the valleys. Alluvium predominates the Little River drainage basin which feeds Lake Thunderbird (65).

Soils. Little River State Park is located in a Darnell-Stephenville soil area. The Darnell are shallow, light-colored soils on slopes and narrow ridge tops. Locally, they are covered with sandstone rocks on the steeper areas, and ledge rock outcrops are common. The Stephenville are moderately deep soils with developed subsoils that occupy the ridges and gentle slopes.

Climatology

Average daily maximum temperatures in this area range from 48 degrees in January to 95 degrees in July and August, while daily minimum temperatures average about 28 degrees in January and 70 degrees in July and August. Temperatures of 90 degrees and higher are common from June through September and are observed on approximately 75 days of the year. In some years, as many as 15 to 20 consecutive days with temperatures of 100 degrees or higher have been recorded. During the colder part of the year, freezing temperatures (32 degrees or below) are recorded on an average of 80 to 85 days during the year.

Average yearly precipitation for the Lake Thunderbird watershed is 34 inches. Spring is the wettest season,

receiving 33 per cent of the total year's moisture and May is the wettest month of the year, receiving 15 per cent of the total moisture. Mean annual snow fall is 6 inches and precipitation occurs mainly during the months of January and February (63).

These factors indicate a slow growing, relatively small, dense-type vegetation on a sloping terrain. They would further indicate a very fragile natural system. Any clearing of vegetation could result in soil erosion, increased turbidity of water, loss of wildlife habitat and the rapid loss of the natural beauty of the area.

Little River Watershed

Little River is a major tributary of the Canadian River and its source is between Norman and Oklahoma City on Hog and Elm Creeks. These creeks enter Thunderbird Lake from the north and the dam is located at river mile 96.2 Little River flows easterly below the dam to its confluence with the Canadian River at river mile 102.4 The Little River drainage area has a length of 120 miles and encompasses a total of 973 square miles.

Lake Thunderbird

In 1961, the citizens of Norman, Midwest City and Del City, Oklahoma, overwhelmingly approved contract proposals submitted to them providing for repayment to the federal

government of the major portion of the cost of constructing a reservoir on Little River east of Norman. The principal purpose of this reservoir was to provide water for municipal and industrial uses in the three cities (66). In addition, the federal government underwrote those portions of the reservoir cost that provided for downstream protection from flood damage, improvement of fish and wildlife resources, and substantial recreational opportunities for citizens of Oklahoma and the nation.

In order to jointly administer the project for the three cities, the Central Oklahoma Master Conservancy District (COMCD) was created by the Legislature of the State of Oklahoma. In September, 1962, construction was begun on the dam of the Little River by the Bureau of Reclamation.

The dam which was completed in 1965 is at river mile 96.2 and rises about 100 feet above the stream bed. The reservoir had a total storage of 196,200 acre-feet, of which 76,000 have been reserved for flood control and 119,600 for water supply and sedimentation. At the top of the conservation pool, surface area is 6,070 acres with a shoreline of about 86 miles. At the time of this study the deepest point in the lake was approximately 65 feet, with a mean depth estimated at 40 feet, and a volume as of September 1, 1972, of 98,809,000 acre-feet (54).

Little River State Park

This park was constructed upon completion of the dam and the filling of the reservoir. The park consisted of about 4010 acres and surrounds Lake Thunderbird. The lake and the road systems provided a natural barrier which divided the park into two general areas. Indian Point on the north side of the lake and Clear Bay and Little Axe on the south serve as the major use areas of the park (Figure 2). Developed park land at the time of this study consisted of about 1834 acres and included: two swimming beaches, one enclosed fishing dock, 404 picnic tables, 114 grills, seven combination shower/comfort stations, 13 covered shelters, nine boat ramps and 60 electric hookups for trailers and campers. There were combination information centers and grocery stores located at the entrances to both Indian Point and Clear Bay areas and a marina at Indian Point which served as a fishing supply and boat service/rental center. In addition, there was a small archery range at Indian Point and a riding stable at the Clear Bay area (67).

The vast majority of all recreational activity occurred at Indian Point (Areas A and B), Little Axe and in the Clear Bay area (Figure 2). These areas consisted of approximately 1000 acres and included almost all of the developments mentioned previously, i.e., picnic tables, grills, shelters, hookups, etc.

Access to the entire facility was provided primarily by two roads, State Highway No. 9, which is oriented east-west and passed south of the facility and Old State Highway No. 9, which intersected the lake from east and west. Developed roads within the park provided access to boat ramps and use areas and were constructed with asphaltic surfaces. The estimated capacity of Little River State Park was 5,000 persons.

Thunderbird Public Hunting Area

This public hunting area which was managed by the Oklahoma Department of Wildlife Conservation consisted of approximately 2400 acres or 1200 acres each on the upper Little River Arm and the Hog Creek Arm of the reservoir. These areas provided good squirrel, rabbit, quail and waterfowl hunting with some deer and turkey to be found in season. The managed habitat also provided for numerous non-game species for the enjoyment of bird watchers and other wildlife enthusiasts. The greatest influx of users at any one time occurred during waterfowl seasons when large numbers of hunters utilized the water portions of the hunting areas. There were no developed facilities and most roads were not hard surfaced in and around the public hunting areas (68).

Management of this recreational facility was the responsibility of a multiplicity of agencies:

a) The COMCD for the water, its use and protection.
b) Oklahoma Division of State Parks for Little River State Park.

c) Oklahoma Department of Public Safety for Water Safety.

d) Oklahoma Department of Wildlife Conservation for the Thunderbird Public Hunting Area.

e) Norman City Police for highway safety on some roads.

f) Cleveland County Sheriff for highway safety and law enforcement in some areas.

g) Oklahoma State Highway Department for roads.

h) Cleveland County Health Department for health and sanitation.

i) City of Norman for land-use planning and facilities in the immediate area.

j) Private contractors for marina operation.

The involvement of so many agencies resulted in overlapping authority in some areas, undelineated authority in others, uncoordinated activities in practically all areas and thus major deficiencies in the management of the overall recreational facility.

Environmental Problems

The complexity of the management organization coupled with a substantial influx of recreational users resulted in numerous environmental hazards and general problems. The primary contributor was the massive overload of the facilities during the peak recreational season.

Overpopulation

The number of users has reached a phenomenal level since the construction of Lake Thunderbird. Figure 3 reveals that there has been an average of over 2,000,000 visitors per year in recent years (67). These visitors have for the most part utilized the small developed facilities mentioned previously. That is, around 1000 acres have supported most of the major land use. Figure 4 shows that over 54 per cent of the users visited the area during a 4-month period. However, these data do not indicate the magnitude of the situation. Over 1.3 million persons visited the facility in about 16 weekends during the 4 month period. These data indicate that as many as 40,000 visitors utilized the park on individual days during the summer of 1972. As was indicated previously, the extimated maximum capacity of the facility was 5,000 persons.

Observed congestion within the park on some days reached phenomenal levels. Automobiles and campers were observed parked at virtually every accessible location throughout the park, even on the grass, under the trees, and at other undesignated locations. Families were observed camped with 6 inches to a few feet between vehicles or tents. New roads were constructed by the visitors throughout the use areas. Vegetation was removed to make room for tents and camping vehicles, and grass and other vegetation was destroyed. The most critical areas in terms of overpopulation and

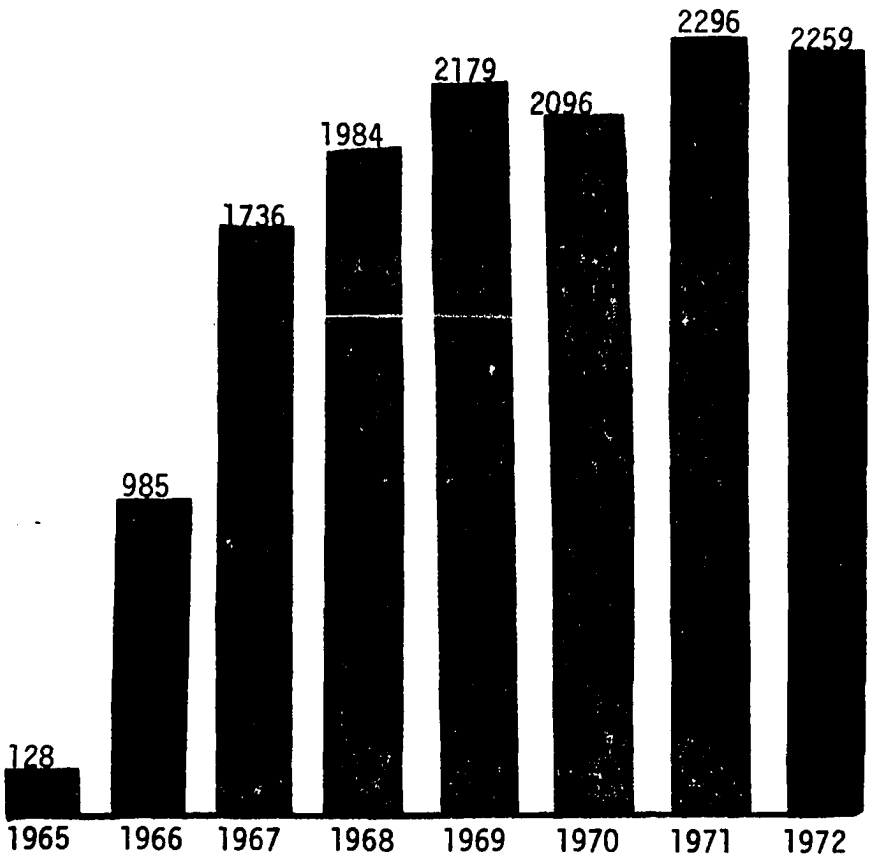

Figure 3 - Estimated Yearly Attendance at Little River State Park (Thousands)

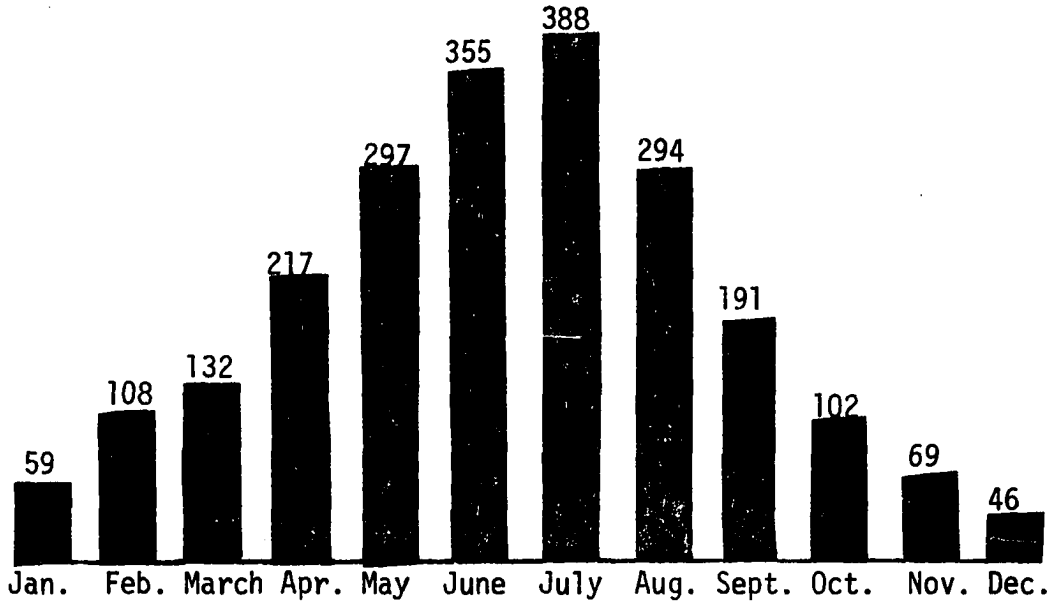

Figure 4 - Estimated Monthly Attendance at Little River State Park (Thousands)

destruction were areas B and Little Axe. In areas where vegetation was destroyed, soil erosion began and there were massive gullies along the hilly areas leading into the lakes where the turbid water reflected the topsoil it had received from the camping areas.

During the week-ends, boaters had to wait in long lines to launch their crafts. During May, June and July, boat populations on the water reached approximately 1000 per week with most of these being present during the weekend. On some days, there were over 500 boats on the lake (69).

The massive overpopulation of the facilities was directly associated with numerous other environmental problems and hazards.

Water Quality

The water in Lake Thunderbird was of generally good quality for both drinking water and recreational use. During the winter months and other periods when recreational use was low, the fecal coliform counts per 100 ml of sample were negligible. However, during the peak recreational season, the bacteriological quality reflected a potential health hazard to the recreational user. Counts as high as 1600 fecal coliform per 100 ml were recorded adjacent to swimming areas, and as high as 450 fecal coliform per 100 ml in the marina area (54). The bulk of the fecal coliform presence in these areas was a direct result of the amount of body contact.

Therefore, the overpopulation of some areas during the peak season created a definite health hazard for those engaged in water contact sports.

Turbid water was found throughout the summer adjacent to the major use areas. This was caused by an unlimited number of swimmers in unauthorized as well as authorized swimming areas and by soil erosion from denuded camping and picnicking areas and by beach erosion resulting from the wave action of an overpopulation of power boats.

Solid Waste

The solid waste problems at this facility were two fold. First, the amount of solid waste generated by recreational activities is enormous; consequently, conventional methods such as those employed at the park were not able to cope with the situation and secondly, the users did not attempt to utilize containers that existed and scattered their litter throughout the facility.

The number of people visiting this facility during the peak 4-month period created an amount of refuse equivalent to that generated by a city of 97,000 people (70). Even if the user took advantage of the open 55-gallon storage containers (garbage cans), there would still have been substantial problems associated with solid waste disposal. The containers were in need of cleaning and sanitizing and served as a food source and breeding place for potential disease carrying

insects. From this standpoint they represented a substantial health hazard to the user population. Removal of the solid waste deposited in containers was no small task and the authorities were understaffed and ill-equipped to perform these functions. Even after the refuse was removed it was burned in the disposal site in what appeared to be a violation of the "Oklahoma Clean Air Act of March 1, 1972." In addition, insects and vermin were a significant problem at the disposal site.

A major problem in the facility was the scattering of litter throughout the facility by the user population. The individuals deposited beer cans, broken glass, paper and other items over the landscape. Not only was the effect esthetically unpleasing but broken glass presented a major hazard both on the shore and within the water.

Crime and Vandalism

During 1971, over 245 crimes ranging from murder and muggings to minor traffic violations and theft of camping equipment were reported to the Norman Police Department and Cleveland County Sheriff's office as occurring within this facility (71). Another indication of the nature of the user population was the fact that over 157 arrests were made and over 100 warnings given by the Oklahoma Highway Patrol on one weekend during the summer. Charges included driving under the influence of alcohol, speeding, driving unsafe vehicles, and driving under license suspension (72).

Perhaps this magnitude of crime was not out of proportion when it is considered that people had created an instant weekend city removed from conventional municipal services and facilities. It was clear, however, that the users of this facility did not fit the image of the "all-American outdoorsmen." It is believed that the magnitude of the crime problem was much greater since due to the remote nature of the facility many incidents were not reported to authorities.

Nuisance

The large influx of recreational users presented other problems for managing authorities and for their fellow recreators. Not only did the user bring himself and his family, but he brought television sets, transistor radios, dogs, cats, motorcycles and other items. Even though noise levels were not recorded, observation and user complaints left little question that noise was a major nuisance to many of the users of the facility.

It was not uncommon for motorcycles with noisy mufflers to travel between tents and picnic tables and through the undeveloped areas of the park destroying vegetation. Even though dogs and cats were required to be leashed, they were commonly seen running loose. Flies were observed in large numbers and were the subject of many user complaints.

Consumption of alcoholic beverages was a favorite recreational activity and intoxicated persons were a problem for many people who were recreating with their children. The evidence of the popularity of alcoholic beverages was evident in the refuse containers and throughout the facility where beer cans and whiskey and wine bottles were principal contributors to the amount of solid waste.

Water Safety

As was previously noted, on some days in mid summer, there were over 500 boats on the lake. Evidence that the users of this facility were novices was not as prevalent at any site to the extent that it was upon the water. Required safety equipment such as life jackets was rare and knowledge of safe boat operation and regulations was likewise rare among boaters. Since there were no designated use areas or traffic patterns for incompatible activities such as fishing, water skiing, and sailing, all water-related activities presented many hazards. It was common practice to moor boats and "drop" water skiiers in the areas where children swam. In Area B and at Little Axe, one could observe innumerable skiiers and boats among swimmers. There were seven drownings during 1972 on Lake Thunderbird (73) and it was miraculous that additional drownings did not occur. From May 5 through September 5, 1972, there were 36 citations issued to boat operators, and 131 assists of boaters in trouble by the Lake Patrol;

however, these low figures probably reflected the lack of enforcement manpower rather than the behavior of boat operators (69).

High winds were common at this facility and small craft warnings were frequently posted; however, the warning flag had little effect on the behavior of many of the boat operators. It was not uncommon for small craft to capsize or to be blown aground by the strong winds requiring rescue by fellow boaters. Obviously, there was no way to determine how representative the users of Lake Thunderbird and Little River State Park were in relation to the recreation public at large; however, if this population was representative, there will be some difficult problems for authorities who manage public recreational areas.

Summary

There was no question that severe problems were documented at this recreational facility during 1972. The implications for more planning and more control of the user public were obvious and required immediate attention. Since recreational facilities belong to all the people, it was deemed important to determine the awareness of the user public to documented problems. It was felt that if the user public was aware of problems and appeared to support corrective action, then rapid steps by managing authorities would be easier to institute. Additionally, it was essential that the exact nature of the user population and his activities be documented.

Perceptions of the User Population

Environmental Hazards

Investigation of user awareness of environmental hazards in the park indicated that visitor recognition and concern over such hazards was substantial. As may be seen in Table 1, 44 per cent of the interviewees were aware of environmental hazards in the park. More importantly, 54 per cent of the users in Little Axe and Area B combined indicated the presence of environmental hazrads. As was previously noted, these areas support substantially greater populations and experience more significant environmental destruction.

TABLE 1

USER AWARENESS OF ENVIRONMENTAL HAZARDS BY AREA

Use Area	Total Interviewed	Number Showing Awareness	Percentage
Area B	60	34	56.6
Clear Bay	23	6	26.1
Little Axe	39	19	48.7
Area A	14	4	28.6
Other	14	3	21.4
TOTAL	150	66	44.0

When the nature of the specific environmental hazards was examined, it was seen that there were three major areas of concern to the user (Table 2). First, 21 per cent of all

TABLE 2

SPECIFIC ENVIRONMENTAL HAZARDS MENTIONED BY USERS BY AREA

Area	Number Responding	Environmental Problems		Enforcement Problems		
		Over-population	Pollution	Adverse Behavior on Water	Adverse Behavior on Land	Nuisance Complaints
Area B	(34)	17	4	14	8	5
Clear Bay	(6)	4	2	1	2	1
Little Axe	(19)	4	3	12	4	-
Area A	(4)	1	3	2	3	-
Other	(3)	2	-	2	1	-
TOTAL	(66)	28	9	31	18	6

persons interviewed indicated that adverse behavior of boaters and water skiiers was a significant problem. Water safety was of such great concern that demands for increased enforcement related to boating safety were expressed by 27 per cent of all persons interviewed (Table 3). The majority of such suggestions involved enactment of Coast Guard regulations, instruction or licensing of boat operators, more strict control of boaters, traffic patterns for boats, or additional lake patrol personnel. Planners have tended to consider outdoor facilities in terms of users not accepting significant controls on the population. The suggestions by this user population would indicate that people will not only accept more rigid controls, but will demand rules and regulations to protect the user and the natural environment.

The second most important environmental problem as perceived by the user was overpopulation of the land facilities. Analysis of the attendance data (illustrated graphically in Figure 4) indicates that over 54 per cent of the visitors were present during only 4 months of the year. Not only was the impact greatest during this short period, but further analysis revealed that most of the visitors were present during the weekends on that 4-month period; therefore, it could be estimated that over 1.3 million persons visited this small park on approximately 16 weekends. Thus, the magnitude of the overpopulated conditions during this period are revealed. Overpopulation was viewed as a problem by 19 per cent of the

TABLE 3

SUGGESTIONS BY USERS FOR IMPROVEMENT BY AREA

	Area B	Clear Bay	Little Axe	Area A	Other	TOTAL
Number of users suggesting improvement	48	12	20	6	6	92
Suggestions						
(Enforcement)						
Licensing or control of boaters	12	3	9	-	2	26
More Lake Rangers	4	1	5	1	1	12
More Park Rangers	4	1	4	-	1	10
Ban motorcycles	4	-	-	-	-	4
Limit # of boats	2	-	-	1	-	3
Restriction on dogs	2	-	-	-	-	2
Limit # of people	3	-	-	1	1	5
More life guards	1	-	-	1	-	2
Fees to limit people or make improvements	2	1	-	1	1	5
(Facility Improvement or Change)						
More electrical hookup	10	1	7	-	-	18
More camping areas	9	1	4	-	-	14
Formal campsites c slab	8	2	2	-	1	13
More bathrooms	7	3	2	-	-	12
Extend beaches or sand, buoy off more areas	5	1	4	4	-	14
More boat ramps	3	-	3	-	-	6
More water faucets	3	-	-	-	-	3
Improve roads	1	2	3	-	-	6
Sewer hookups for trailers	3	-	-	-	-	3
Lids on trash cans	2	-	1	-	-	3
Designated duck blinds	-	-	-	-	2	2
Remove all elec. outlets	1	-	-	-	-	1

persons interviewed. The suggestions of the users for alleviating the crowded conditions were varied and provided no specific recommendations to be followed; however, the suggestions generally involved placing a limitation on the number of users by charging fees or designation of a limited number of camp sites. Another frequent suggestion was that the camping facilities be expanded into unused areas of the park. The latter response to the problem would only tend to expand the magnitude of the problem since there would still be no control of the population. The key to solving overpopulation problems must be planning and control of existing areas rather than expansion of use areas.

Adverse behavior of other users on land was mentioned by 16 per cent of those interviewed. These complaints centered primarily around noise, vandalism, theft, unleashed dogs or motorcycle use. Suggestions for improvement included stricter regulations and the addition of more park rangers. There was some feeling that motorcycles should be banned from the park.

Even though the user was very much aware of water safety, overpopulation and adverse behavior of users on land, this population gave little recognition of some major environmental problems. The chopping of trees for firewood, destruction of grass and underbrush and soil erosion were evident throughout the park but were not noted as significant problems by the users. However, litter and turbid water from user

activities were mentioned by 6 per cent of the user population. Therefore, it can be said that the user was not aware of most problems associated with destruction of the physical environment but had some awareness of litter and water turbidity, factors which were tabulated in Table 2 as pollution.

The documented concern over environmental hazards to the user and the endorsement of additional laws and regulations along with increased enforcement will be of great value to the responsible agencies. This information will provide these agencies with a view of the will of the recreational public as it regards safety in recreational facilities. The willingness of the user to tolerate restrictions was a new parameter which has infrequently been considered by planners and managers of recreational facilities. If the outdoor facility is to be safe for users and protected from environmental degradation by the user population, stringent control of the population must be instituted. There is an additional need for planners and managers of facilities to establish and maintain continuous communications with the user population.

Accident and Disease Experience

Data concerning the recreationally related accident and disease experience of the user and his immediate family were collected for the 12-month period preceding the actual field study. Reported data indicated that during this period

accidental injuries requiring treatment by a doctor or in an emergency room were suffered within the park by 2.1 per cent of the family members of the individuals interviewed (Table 4). Assuming this rate to be valid for the total user population, the magnitude of the accidental injury problem was estimated as follows. Since the average user group size was 7.2 persons and the average number of trips per year per group was 6.7, there were 47.6 visits per user group (see supporting data presented in a later section). Since there were 2,300,000 visits during 1971, there were a total of 48,349 groups visiting. It was also found that 62 per cent of each user group included immediate family members of the interviewee, therefore 29,976 families. Since the average family size was 4.4 members, it was assumed that there were 131,894 family members in the eligible population. Therefore, there were an estimated 2,769 accidental injuries requiring treatment by a doctor or in an emergency room during the 12-month period.

Diseases were reported as occurring within the park by 1.9 per cent of the persons within the immediate families of the individuals interviewed. Assuming this rate was also valid for the total user population, there were 2,446 persons who suffered from a disease in Little River State Park and on Lake Thunderbird during 972 (Table 5). It was noted that the major disease experienced was ear infection and all of the documented cases occurred during the month of July, the peak of the recreation season.

TABLE 4

FREQUENCY OF USER ACCIDENTS REQUIRING TREATMENT DURING A 12-MONTH PERIOD*

	Lacerated Feet	Other Lacerations	Motor vehicle Accidents	Burns	Fractures	Work Accidents	Other	Total
Accidents in park	1.5	0.3	0.3	--	--	--	--	2.1
Overall Accident Experience	1.8	--	0.1	0.1	0.1	0.3	0.5	2.9

*Percentage of population experiencing indicated accidents.

TABLE 5

DISEASE OCCURRENCE AMONG USERS DURING A 12-MONTH PERIOD*

	Ear Infection	Poison Ivy	Coronary	Other Diseases	Total
Disease occurrence in park	1.8	0.1	--	--	1.9
Overall disease occurrence	--	--	0.1	0.3	0.4

*Percentage of population experiencing disease.

The accident and disease problem reveals a significant problem which has been overlooked by planners of recreational facilities and indicates that the need for emergency medical facilities should be considered as an integral part of the planning and management of recreational environments especially when such facilities are remotely located with respect to urbanized medical services.

Use Patterns of the Study Population

Group Size

There was an average group size of 7.2 persons among the interview population (Table 6). These data showed that among the sample population, there was an average of 4.4 family members, approximately one relative and 1.7 friends in each group. The only variation among these data was in the other areas of the facility, where these interviews represented primarily users of the enclosed fishing dock and the public hunting area where persons were found in smaller groups.

Distance Traveled

Almost all of the visitors to Lake Thunderbird and Little River State Park came from Cleveland and adjoining counties, with approximately 70 per cent of the users coming from that portion of the Oklahoma City Metropolitan area located in Oklahoma County (Table 7). Furthermore, less than 5 per cent of the users came from outside Oklahoma.

TABLE 6

GROUP CHARACTERISTICS OF THE USER POPULATION

	Number Interviewed	Family Members	Relatives	Friends	Total	Average Group Size
Area B	60	225	82	78	445	7.4
Clear Bay	23	93	16	24	156	6.8
Little Axe	39	130	52	127	348	8.9
Area A	14	56	6	19	95	6.8
Other	14	9	4	12	39	1.8
Total	150	513	160	260	1083	7.2

TABLE 7

RESIDENCY OF USER POPULATION BY USE AREA

	Area B	Little Axe	Clear Bay	Area A	Other	Total	Per Cent
Oklahoma City	24	24	8	6	5	67	44.7
Moore	9	-	1	4	1	15	10.0
Norman	3	4	5	3	4	19	12.7
Midwest City	6	1	2	-	1	10	6.7
Bethany	4	1	-	-	1	6	4.0
Del City	2	-	-	-	2	4	2.7
Shawnee	-	4	-	-	-	4	2.7
*Other Oklahoma Towns	10	5	3	-	-	18	12.0
Out of State	2	-	4	1	-	7	4.7
Total	60	39	23	14	14	150	100.0

*Includes 15 cities or towns in Oklahoma.

An analysis of distance traveled also reflected this trend among users. The average distance traveled by the sample population was 31.8 miles and only 13 users traveled more than 70 miles to this recreational facility (Table 8).

TABLE 8

DISTANCE TRAVELED FROM HOME (MILES)

	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70+	Out of State
Area B	1	5	15	18	10	3	1	5	2
Clear Bay	-	7	1	9	1	1	-	-	4
Area A	1	3	6	3	1	-	-	-	1
Little Axe	1	8	11	12	5	1	-	1	-
Other	-	6	6	1	1	-	-	-	-
Total	3	29	39	43	17	5	1	6	7

$\bar{x}$ = 31.8 miles

Major Activity

Fishing was the primary activity and was indicated as the major activity of 27.3 per cent of the population (Table 9). Camping was the second most important activity and was the major activity of 26.0 per cent of the users. Other major activities included: Water skiing, 17.3 per cent; swimming, 16.0 per cent; boating, 8.0 per cent; hunting, 4.0 per cent; and picnicking, 1.3 per cent. The most revealing statistic

TABLE 9

MAJOR OUTDOOR ACTIVITY BY PERCENTAGE OF THE USER POPULATION

	Area B	Little Axe	Clear Bay	Area A	Other	Total
Fishing	30.0	20.5	21.7	7.1	64.3	27.3
Camping	28.3	30.8	43.5	--	--	26.0
Water skiing	30.0	12.8	8.7	7.0	--	17.3
Swimming	1.7	20.5	13.0	85.7	--	16.0
Boating	8.3	12.8	8.7	--	--	8.0
Hunting	--	2.6	--	--	35.7	4.0
Picnicking	1.7	--	4.3	--	--	1.3

was the selection of picnicking by only 1.3 per cent of the population. This would indicate that picnicking was not a major activity at this facility, but rather an ancillary activity; therefore, it has been inappropriate to count users as picnickers because they are seen around picnic tables as had been a common practice. There was little question that the picnic tables served as a focal point for the camper or fisherman at this facility. Over 86 per cent of the users interviewed indicated that their major activity was either fishing, camping, water skiing, or swimming.

The presumption that "drive through" observation of the visitor population will give indications of the major usage of the facility is inappropriate and studies to indicate the characteristics of the user population should include an interview of the user.

Other Use Characteristics

As has been shown previously, the user usually had one primary activity which prompted the trip to the outdoor recreational facility. In addition, the user performed an average of 2.4 ancillary recreational activities during each trip (Table 10). It can be seen that there were four major ancillary activities which included camping, picnicking, boating, and swimming.

It has been the practice in demand studies to assign time and space to the user for each activity mentioned by the user for the determination of activity days (74). This method of determining total activity days for recreational facilities appears to have been inappropriate. Users tend to occupy a space, during a time span to perform a number of activities within this framework. The user must frequently has had one major activity such as camping which is supported by ancillary activities such as picnicking. This second activity simply reflects the need for the camper and his family to eat while at the campsite. Based on the data collected during this study, it must be concluded that many prior estimates of user demand are inflated or excessive by a factor of over 2.4.

A compilation of user data from Appendix B reveals that a composite of the interviews from a selected sample of the population yielded the following. The average user:

TABLE 10

PRIMARY VERSUS SECONDARY RECREATIONAL ACTIVITIES

	None	Fish	Picnic	Camp	Sight See	Nature Study	Hunt	Boat	Water Ski	Swim	Sun Bath	Hike	Other	$\bar{x}$
Fishing	7	-	14	23	6	2	2	21	10	13	5	2	-	2.4
Camping	5	15	16	-	7	5	-	13	10	26	6	9	-	2.7
Picnicking	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Sight Seeing	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nature Study	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hunting	5	-	-	1	-	-	-	-	-	-	-	-	-	0.2
Boating	-	6	1	6	-	-	-	-	9	6	2	-	-	2.5
Water skiing	1	10	11	18	1	-	-	18	-	18	10	1	1[a]	3.4
Swimming	4	5	9	4	2	1	-	3	2	-	9	2	1[b]	1.6
Sun Bathing	-	0	-	-	-	-	-	-	-	-	-	-	-	-
Hiking	-	0	-	-	-	-	-	-	-	-	-	-	-	-
Totals	24	36	51	52	16	8	2	55	31	63	32	14	2	2.4

[a] motorcycle riding.

[b] horseback riding.

a) visited the facility 6.7 times per year, mostly during the summer months and stayed 49.7 hours each visit,
b) was a member of a group of 7.2 individuals of which 4.4 persons were members of the immediate family,
c) traveled 31.8 miles from his home to the facility,
d) was 36.5 years old, had completed 12.4 years of education and was married, and
e) had 2.5 children and had a gross family income of $9,744 during 1971.

Ecological Model

The logical extension of a study involving the applicability of an ecological approach was a description of the ecological relationships encountered. The first interactions that were apparent in such an analysis were the cause and effect relationships between dual components. A good example was the occurrence of lacerated feet among the users in areas with high levels of litter. By establishing this relationship it would be possible to develop a quantitative index of the amount of litter, which should present a measure for predicting the incidence of lacerations. Additionally the measure of bacteriological water quality and the incidence of certain diseases could also enable the researcher to provide another segment of a predictive model. Other relationships can be developed from numerous components of the recreational system. It was demonstrated for instance that the

terrestrial system was extremely fragile due to the nature of the topography, climatology, soils, and vegetation. The infringement of too many people into this system resulted in destruction of vegetation which in turn was followed by soil erosion. Soil erosion contributed to the turbidity of water. Of course, the overall effect was a natural system which was esthetically unpleasing.

An ecological model which is presented in Figure 5 demonstrates the total ecological system. This model might be considered as 3-dimensional in time and involves some interactions which cannot adequately be shown. The central core would be the environment and population characteristics are represented by the large spheres in the center of the model. For study or planning related to the recreational facility, four major factors might be considered. These include the terrestrial environment, aquatic environment, rules and enforcement, and man-made facility design. Either of these second level ecological factors could be selected as the primary thrust of a study as long as the others are considered within the analysis. The characterization of first and second level ecological factors provides an in-depth analysis of the human and environmental factors which must be considered in outdoor recreational facility design and planning.

The third level of ecological relationships provides a measure of the success or failure of the interaction of level one and level two of the ecological system. In other

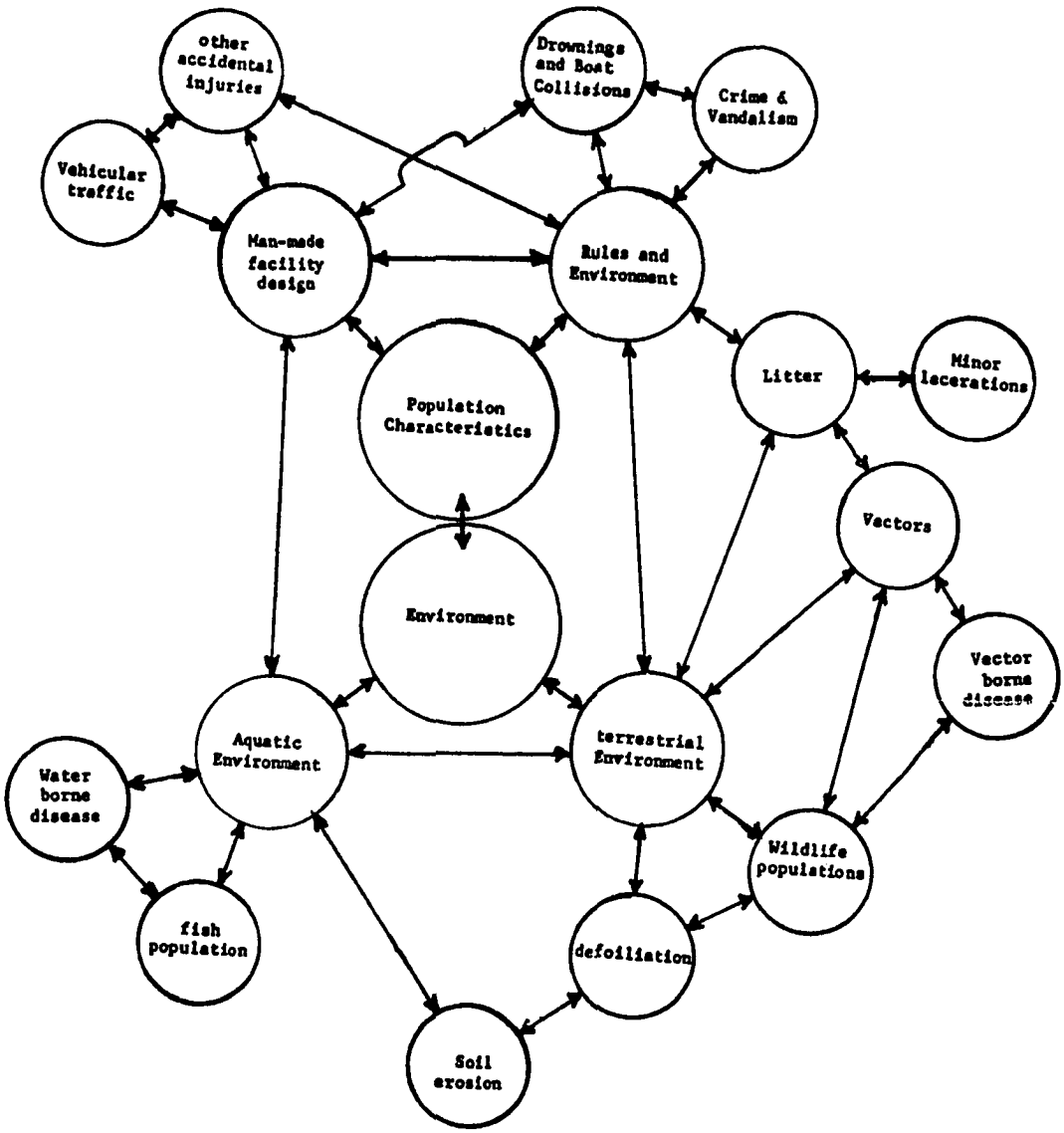

Figure 5 - Ecological Model for Analysis of Outdoor Recreational Facilities

words, some of these factors represent system disequilibrium or problems within the facility. Other third level factors such as wildlife populations, represent the positive characteristics of a facility. The removal or alteration of one factor might well affect some or all of the other factors. By analyzing the third level ecological factors within the context of levels one and two, a meaningful evaluation of a facility can be provided.

The management of levels one and two to correct for problems identified within level three would be the essence of providing a quality recreational experience. An example might be delineated in the area of rules and enforcement. If it is determined that water safety problems exist, the responsible agency should proceed in the following fashion. First, they should establish the magnitude of the water safety problem. Then, they should consider the applicable rules and the extent to which the risk population follows such rules. At this point, it would be important to examine the appropriateness of rules and to determine the characteristics of the user population. All of these factors should then be considered within the context of the overall environment.

Such an in-depth analysis could be provided within any factor or series of interactions located within the ecological model. This type of approach is exceeding important to outdoor recreation research. In the past, few studies have gone beyond the core of the model (level one); therefore,

sufficient information has not been provided relative to the total recreational facility. By employing all of the evaluations expressed within levels one, two and three of this model, a truly comprehensive approach can be employed utilizing the ecological method.

CHAPTER VI

SUMMARY AND CONCLUSIONS

This research involved the development and application of the ecological method to evaluate the interactions of the physical, biological and social factors that are operational within the outdoor recreational environment. This methodology was developed at Lake Thunderbird, a small water-oriented recreational facility plagued with overpopulation and other environmental problems. All available physical and biological data were collected from responsible agencies and then utilized to develop an environmental profile of this recreational facility.

Sociological data were developed by conducting in-depth interviews of a sample of the user population. During a 6-month period in 1972, the interviews were conducted to ascertain the awareness of the user to environmental problems, their perception of environmental hazards and adverse experiences of the user and his immediate family. Adverse effects were measured by determining the incidence of disease and injury within the study population.

The sociological data from the interviewed population were then analyzed within the context of the environmental

profile and demographic data that were collected.

Based on the results and observations of this study it was concluded that, relevant to the total outdoor recreational system, the ecological approach must be employed for the planning and evaluation of outdoor recreational facilities. This methodology provided a broad context for analysis of the multiple interactin influences present when man entered this environment.

Based on the application of the ecological method at Lake Thunderbird, it was found that the absence of such an approach resulted in numerous environmental hazards and environmental problems. For the planning of a facility and control of user populations, it was found that the absence of such an approach resulted in poor planning, single-purpose design of facilities, and inadequate regulations and enforcement. Specific problems identified were the following:

1. overpopulation of the land and water facilities,
2. destruction of vegetation by the user and his equipment,
3. bacteriological water quality indicative of a potential health hazard,
4. solid waste problems resulting from an inadequate system for refuse handling and the littering of facilities by irresponsible users,
5. crime and vandalism on land facilities and upon the water,
6. excessive noise and other abuses of fellow users,
7. drownings and other water safety problems,

8. waterfowl blinds of poor construction and a source of complaint by legitimate sportsmen, and
9. a lack of coordination among responsible agencies.

Many of these problems can be eliminated and others diminished by this type of evaluation when appropriate corrective action is taken.

Users of the study facility were aware of environmental problems and hazards and demanded action by authorities. Therefore, it was concluded that the user population was ameable to strict regulations and enforcement within recreational facilities.

Based upon the conclusions reached as a result of this study, the following recommendations can be made:

1. The ecological approach must be utilized for the study of existing outdoor recreational facilities both for the documentation of problems and for the prediction of potential environmental problems and hazards. This broad context for analysis must also be used in the design and planning for new facilities.
2. A number of recommendations related to the study facilities, Lake Thunderbird, Little River State Park and Thunderbird Public Hunting Areas can be made, including:
   a. A limited number of camp sites should be designated by park authorities.
   b. The user population should be limited to those who occupy designated facilities.

c. Motor vehicles should be allowed only on designated roads and parking lots.

d. The cove areas at Area B and at Little Axe should be restricted to use by swimmers, provided with sand and lifeguards and designated as public swimming areas. Swimming should be limited to these areas and the two public beaches.

e. Fees should either be charged at all four swimming areas or at none of them to promote uniform use.

f. The 55-gallon refuse containers should be provided with lids and should be emptied frequently during the summer season. Collected material should be disposed of within the guidelines and constraints on municipal solid waste collection systems.

g. Additional enforcement personnel should be employed in the park. There should be strict supervision of the park and persons should be prosecuted for littering, destroying vegetation, unleashed pets and other nuisance violations. Motorcycles and motorbikes should should be allowed only on designated roads and parking lots.

h. Regulations should be developed to provide a general traffic pattern for boats on the lake and all coves should be off limits to water skiiers. Trot lines should be limited to a designated number of coves.

i. Additional water patrol personnel should be employed and all regulations should be strictly enforced.

j. The Department of Wildlife Conservation should develop waterfowl blinds in the two public hunting areas that are properly and safely placed and prohibit any other construction of blinds. This agency should have a public drawing each year to determine the use of the state blinds.

k. All responsible public agencies should meet and develop a plan for the coordinated management of the overall facility.

3. Provisions for continuous communication between user and provider - manager should be instigated in order that their perceptions of problems can be documented and their support for corrective changes obtained.

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APPENDICES

APPENDIX A

QUESTIONNAIRE

We are conducting a study to find out what your recreation needs are as a user of this kind of facility. We would appreciate your help in providing information on your use of this type of facility and your reasons for using it. Please answer all questions as they relate to you and your experience. Your name will not be connected with the questionnaire.

(1) Please give the number in your party that are

Family members_____ Relatives_____ Friends_____

(2) How far is this lake from your home? _____miles

(3) About how long do you plan to stay here? (Check only one)

____1 hour	____6 hours
____2 hours	____7 hours
____3 hours	____8 hours
____4 hours	____9-24 hours
____5 hours	____Number of days

(4) Give number of times you visited this lake during

1970_____

1971_____

1972_____

This is the first time_____

(5) What is the one most important activity you will do here today? (Check only one)

____Fishing ____Boating
____Picnicking ____Water skiing
____Camping ____Swimming
____Sight seeing ____Sun bathing
____Nature study ____Hiking
____Hunting ____Other_____

(6) Consider your major activity listed above. How long have you performed this activity?

____years How many times each year?_____

(7) Which other activities will you be involved in here today?

____Fishing ____Boating
____Picnicking ____Water Skiing
____Camping ____Swimming
____Sight seeing ____Sun bathing
____Nature study ____Hiking
____Hunting ____Other_____

(8) a. Are you camping? b. Are you camping over night?

____yes ____no ____yes ____no

(9) What do you like most about Lake Thunderbird or Little River State Park?

_____

_____

_____

(10) What do you like the least about Lake Thunderbird of Little River State Park?

_____

_____

_____

(11) What changes or improvements in Lake Thunderbird or the Little River State Park would you recommend?

_____

_____

_____

_____

_____

(12) Would you please give us some information about yourself? People of different ages, occupations, education and income have different preferences. It helps us to know what these differences are. Please do not give your name.

Male_____ Female_____

What age bracket are you in?

____16-19
____20-29
____30-39
____40-49
____50-59
____60-69
____70 and over

(13) What is your occupation?

_____

(14) How many years of schooling have you completed? (Check only one)

____Elementary
____Junior high
____High school
____Jr. College or 2 years of College
____College
____Graduate school

(15) What is your marital status?

____Single ____Divorced ____Widowed
____Married ____Separated

(16) How many children do you have?_____

(17) What was your gross family income for 1971? (Check only one)

____Under $4,000
____$4,000-$5,999
____$6,000-$7,999
____$8,000-$9,999
____$10,000-$14,999
____$15,000-$19,999
____$20,000 and over

(18)

	Farm	Rural Non-Farm	Town under 10,000	City of 10,000-99,999	City of 100,000 or over
Place a check where you lived during your childhood					
Where have you lived during most of your life?					

Where do you live now?_____

(19) Have you or a member of your immediate family suffered any illnesses or accidental injuries at Lake Thunderbird or Little River State Park during the past 12-months requiring treatment by a doctor or in an emergency room?
____Yes ____No

If yes, describe the approximate date, nature of illness, part of the body injured, type of injury, and where treated.

a. _____

_____

_____

b. _____

_____

_____

c. _____

_____

d. _____

_____

_____

(20) Have you or a member of your immediate family suffered any other illnesses or accidental injuries during the past 12 months requiring treatment by a doctor or in an emergency room?

____Yes ____No

If yes, describe the approximate date, nature of illness, part of the body injured, type of injury and where treated.

a. _____

_____

_____

b. _____

_____

_____

c. _____

_____

_____

APPENDIX B

TABLE 11

LENGTH OF STAY FOR INTERVIEW POPULATION BY USE AREA

Length of Stay	Use Area					
	Area B	Clear Bay	Area A	Little Axe	Other	Total
1 hour	-	-	-	1	-	1
2	-	-	2	-	3	5
3	1	1	1	-	-	3
4	1	2	3	4	5	15
5	-	5	1	1	2	9
6	-	1	-	2	1	4
7	1	-	-	1	-	2
8	2	-	2	4	1	9
9-24	7	1	2	5	2	17
2 days	21	7	-	11	-	39
3	13	2	1	5	-	21
4	4	-	2	1	-	7
5	1	-	-	1	-	2
6	1	-	-	-	-	1
7+	8	4	-	3	-	15

$\bar{x}$ = 49.7 hours.

TABLE 12

NUMBER OF TIMES THE PARK WAS PREVIOUSLY VISITED BY USE AREA
1970, 1971 and 1972

Use Area	1st Time	0	<5	5-9	10-14	15-19	20-24	25-29	30-34	35+
1970										
Area B	-	37	3	2	6	1	3	-	6	1
Clear Bay	-	11	4	-	-	1	-	-	-	1
Area A	-	6	1	-	2	-	1	-	-	1
Little Axe	-	17	7	5	2	2	1	1	1	2
Other	-	10	-	-	2	-	1	-	-	-
1971										
Area B	-	25	5	3	9	4	4	1	7	1
Clear Bay	-	6	5	3	-	1	-	1	-	1
Area A	-	4	2	3	1	-	-	-	-	1
Little Axe	-	11	6	5	3	6	3	2	1	1
Other	-	4	3	3	1	-	2	-	-	-
1972										
Area B	1	-	17	10	11	5	3	2	8	3
Clear Bay	6	-	7	4	3	1	-	1	-	1
Area A	3	-	7	1	3	-	-	-	-	-
Little Axe	1	-	12	9	5	1	4	2	1	4
Other	1	-	4	-	2	4	2	1	-	-

$\bar{x}$ = 6.7 times per year.

TABLE 13

SEX OF THE INTERVIEW POPULATION BY USE AREA

Use Area	Male	Female	Total
Area B	34	26	60
Clear Bay	17	6	23
Area A	6	8	14
Little Axe	20	19	39
Other	12	2	14
Totals	89	61	150

TABLE 14

AGE OF THE INTERVIEW POPULATION BY USE AREA

Use Area	Age 16-19	20-29	30-39	40-49	50-59	60-69	70+	Total
Area B	4	11	14	20	7	4	-	60
Clear Bay	1	8	5	6	3	-	-	23
Area A	3	6	3	1	1	-	-	14
Little Axe	3	12	9	10	4	1	-	39
Other	1	4	4	5	-	-	-	14
Totals	12	41	35	42	15	5	-	150

$\bar{x}$ = 36.5 years.

TABLE 15

OCCUPATIONS REPORTED BY THE INTERVIEW POPULATION

Occupation	Number	Occupation	Number
butcher	3	electrician	4
carpenter	4	machine operator	4
retail clerk	7	salesman	4
postal clerk	2	air conditioner tech.	2
engineer	3	housing insulator	1
secretary	5	office clerk	1
electronic technician	13	tool maker	1
construction worker	6	computer analyst	3
painter	1	weather observer	1
housewife	13	biologist	1
sheet metal worker	3	printer	2
truck driver	10	florist	1
bookkeeper	1	bartender	2
mechanic	9	cook	1
dockworker	2	nurse	1
telephone lineman	3	self-employed	3
fireman	2	stock boy	1
policeman	1	service station att.	1
teacher	4	college professor	1
student	12	retired	6
welder	2	waitress	1
x-ray technician	1	sanitarian	1

TABLE 16

AMOUNT OF EDUCATION COMPLETED BY THE INTERVIEW POPULATION BY USE AREA

Use Area	Education Completed					
	Elementary	Jr High	High School	Jr or Tech College	College	Grad School
Area B	1	8	35	10	5	1
Clear Bay	-	4	12	4	2	1
Area A	1	-	6	6	-	1
Little Axe	-	4	24	7	2	2
Other	-	1	8	4	-	1
Total	2	17	85	31	9	6

$\bar{x}$ = 12.4 years.

TABLE 17

MARITAL STATUS OF THE INTERVIEW POPULATION BY USE AREA

Use Area	Marital Status				
	Married	Single	Divorced	Separated	Widowed
Area B	53	5	2	-	-
Clear Bay	18	4	-	1	-
Area A	10	4	-	-	-
Little Axe	29	6	2	-	2
Other	12	1	-	1	-
Total	122	20	4	2	2

TABLE 18

NUMBER OF CHILDREN AMONG THE INTERVIEW POPULATION BY USE AREA (EXCLUDING SINGLE PERSONS)

Number of Children	Use Area					
	Area B	Clear Bay	Area A	Little Axe	Other	Total
0	4	2	-	1	3	10
1	11	3	3	4	2	23
2	21	6	4	13	3	47
3	11	23	1	6	2	22
4	6	3	1	5	1	16
5	1	-	-	3	1	5
6	1	-	1	-	1	3
7	-	-	-	1	-	1
8	-	1	-	-	-	1
9	-	1	-	-	-	1

$\bar{x}$ = 2.5 children.

TABLE 19

GROSS 1971 FAMILY INCOME FOR THE INTERVIEW POPULATION BY USE AREA

Income	Use Area					
	Area B	Clear Bay	Area A	Little Axe	Other	Total
<$4000	8	3	4	3	-	18
$4-5999	5	2	-	6	3	16
6-7999	5	4	2	6	1	18
8-9999	11	6	2	6	6	31
10-14,999	16	6	4	12	1	39
15-19,999	6	2	1	4	1	14
> 20,000	6	-	1	-	-	7
Not stated	3	-	-	2	2	7

$\bar{x}$ = $9,744.

TABLE 20

CHILDHOOD RESIDENCE OF THE INTERVIEW POPULATION BY USE AREA

Use Area	Farm	Rural Non-Farm	Town of <10,000	City of 10,000-99,999	City of >100,000	Not Stated
Area B	18	6	13	12	9	2
Clear Bay	7	3	3	9	1	-
Area A	2	3	1	1	6	1
Little Axe	10	8	5	6	9	1
Other	3	2	5	4	-	-
Total	40	22	27	32	25	4

TABLE 21

RESIDENCE OF THE INTERVIEW POPULATION DURING MOST OF THEIR LIFE BY USE AREA

Use Area	Farm	Rural Non-Farm	Town of <10,000	City of 10,000-99,999	City of >100,000	Not Stated
Area B	4	5	10	20	18	3
Clear Bay	2	3	1	11	6	-
Area A	-	2	-	4	7	1
Little Axe	6	3	4	11	14	1
Other	2	2	2	4	2	2
Total	14	15	17	50	47	7