LAND USE CHANGE ALONG THE ILLINOIS RIVER: A GEOGRAPHICAL ANALYSIS OF OKLAHOMA'S RIVER PROTECTION PROGRAM

By

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PREFACE

This thesis represents the culmination of two years of research pertaining to the interactions between people and a river environment. Hopefully, the results of this endeavor will further the understanding of the relationships between man and the Illinois River environment.

During the last two years, this effort has touched the lives of many people who I wish to acknowledge for their assistance.

First of all, I wish to thank my family for their support. My, better half, Cheryl, is commended for her various forms of support, for without her the following pages would be blank. My Father and Mother, Duke and Marge Horacek, as well as Cheryl's parents, Dr. John and Katie Griffin are also recognized for their support and encouragement. My Grandparents, Mr. and Mrs. G. J. Horacek are thanked for their financial assistance and for recognizing the value of an education. Finally, Myrtle Sloan is thanked for making our stay in Stillwater more comfortable.

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CHAPTER I

INTRODUCTION

In 1970 the Oklahoma Legislature passed the Oklahoma Scenic Rivers Act to protect a selection of the state's remaining free-flowing streams and their environments as recreation resources (Oklahoma House of Representatives, 1970) Among the first rivers designated for protection under this act was the Illinois River. The Illinois is the state's most heavily used stream for recreation purposes (Hecock and Tweedie, 1980; Oklahoma Tourism and Recreation Department, 1976; U.S. Department of Interior, 1978). Its accessibility, however, makes the river environment attractive to various forms of economic development, which currently threaten the purpose of the Scenic Rivers Act. This paper examines patterns of land use change along the Illinois, and relates these changes to different objectives of river resource management.

The Illinois River As A Common Resource

Like other rivers, the Illinois can be viewed as a common resource. Rather than being owned by a single interest, the river can be viewed as the common property

of society (Hardin, 1968). As a common resource, however, the Illinois River is defined as useful by various existing and potential users. More often than not these users have different, and often conflicting, definitions of the functions the river might serve. Thus, conflict develops as individuals and groups compete for the use of the river. When competition among users is not managed, the resource, as defined by one or more users, can be destroyed (Fife, 1971).

The Oklahoma Scenic Rivers Act defines the Illinois River, and adjacent lands, as a high quality riparian environment which is to be protected as an outdoor recreation resource. Allocating the river itself for protection is not a major problem, as it is state property. However, most of the lands adjacent to the river are privately owned, and therefore connot be viewed as common resources. Thus, where lands adjacent the river are not state owned, conflict develops because some landowners reject the offical definition, and, define the riparian environment as suitable for supporting a variety of economic activities. For example, the riverine area is seen by agriculturalists as being capable of supporting large scale animal feeding operations, by land developers as a suitable setting for rural residential development, and by recreation entrepreneurs as an attraction luring customers to their enterprises (Oklahoma Tourism and

Recreation Department, 1976; U.S. Department of Interior, 1978).

These, and other uses of the river resource, are directly associated with the transformation of the river's natural environment (Schultze, 1978). Therefore, it is conceivable that if resource development along the Illinois is not managed in a manner consistent with the Scenic Rivers Act, that the riparian resource as defined by the Oklahoma Legislature, could be destroyed.

Environmental Quality and Land Use

Resource development and environmental quality are directly related; in fact, all resource development alters the environments' natural character to some extent (Marsh, 1898; Chaterjee and Lakshmanan, 1973; Ridker and Watson, 1980; Schultze, 1978). Land use change is a major side effect of most resource developments. In general, the more intensive resource development becomes, the more intensive land usage becomes (Barlowe, 1958; Clawson, 1972; Clawson and Stewart, 1965). As land use intensifies, the environment becomes more used, therefore less pristine or natural. This general relationship allows for the formulation of qualitative statements about changes in the Illinois River environment through examining changing land use patterns (Chorley, 1973; Sauer 1919).

Resource Tenure Situations

In any type of environmental resource protection program, effective control of the resource use is critical. Control of the resource use is often achieved through government management of land use. Management of land use is usually accomplished through strong public intervention mechanisms such as acquisition of lands and regulation of use, or by the weaker method of persuasion (Platt, 1976). The difficulties in instituting resource development controls through land use administration are made clear by the large numbers of protected environments that have been situated on public lands. The use of these lands is much less expensive, and results in less controversy than the attempted protection of environments on lands controlled by private interests.

Unfortunately, the drainage basin of the Illinois is largely in private hands. Over ninety percent of all lands within the valley are controlled by private interests (U.S. Department of Interior, 1978). Land use decisions of private interests tend to focus on profit or captial maximization from the conversion of resources to some type of good or service (Platt, 1976). The use of resources to attain maximum economic return involves resource development, thus intensification of land use occurs. Such resource development, and intensification of land use, is undesireable from a resource protection

standpoint, and must be viewed as conflicting with the purposes of the Scenic Rivers Act.

Less than ten percent of the lands within the Illinois River Valley are in public ownership, a majority of which are managed by the state of Oklahoma (U.S. Department of Interior, 1978). The remainder, a tract located along a downstream segment of the river, is supervised by the U.S. Army Corps of Engineers as a flood pool for Tenkiller Ferry Reservior. Among the more important differences between private and public sector management is the fact that public sector decision-makers usually define long term social and/or environmental objectives. The decisions made by public managers are usually defined in terms of outcomes which benefit society as a whole (Platt, 1976). Along the Illinois, public lands are managed to provide transportation, river access, recreational support services, and flood control (U.S. Department of Interior, 1978; Oklahoma Tourism and Recreation Department, 1976). Public management also involves land uses which affect environmental quality. However, these consequences are balanced against the benefits distributed to all members of society rather than benefits distributed to a few private land owners (Platt, 1976).

Both public and private land owners along the Illinois River have management objectives associated with

resource development, thus their disagreements with environmental protection objectives are clear. In order to attain environmental protection objectives, environmental management mechanisms independent of resource development objectives are necessary (Conacher, 1978; Stankey, 1982). A few years after the Scenic Rivers Act was passed, it became apparent that the original legislation was inadequate to protect the Illinois River environment because it lacked such a management mechanism (Oklahoma Tourism and Recreation Department, 1976). These concerns resulted in the passage of amendments which established criteria for the formation and operation of scenic rivers commissions. According to these amendments, commissions are to be established, where desired, to manage the environments of designated scenic river areas in accordance with the Scenic Rivers Act. These commissions are designed to coordinate the resource demands of landowners, recreationists, and conservationists through representation of these interests on each functioning commission (State of Oklahoma, 1977).

The Oklahoma Scenic Rivers Commission

In 1978 the Oklahoma Scenic Rivers Commission (O.S.R.C.) was established to manage the Illinois River environment in a manner consistent with the Scenic Rivers Act. In accordance with the amended act, the O.S.R.C. was

granted powers to prepare and establish minimum performance standards for planning, zoning, and regulations necessary to achieve objectives of the act. In addition, the O.S.R.C. is authorized to prepare and adopt a management plan, or plans, to guide and coordinate private activities and public programs.

These amendments created a cooperative river management program through which land use along the Illinois River can be coordinated to afford environmental protection. However, the O.S.R.C. has been the subject of controversy because of its unwillingness to adopt either regulatory controls or management plans for coordinating land use. At the heart of this controversy is the commission's membership, which consists mainly of local representatives. This situation is the result of membership policies, outlined in the Scenic Rivers Act, that favor local representation.

Those concerned with the Illinois River believe that the present commission serves only the interests of local landowners and does not perform in a manner consistent with the Scenic Rivers Act (U.S. Heritage Conservation and Recreation Service, 1979). This viewpoint seems to be supported by recent actions of the O.S.R.C.. Actions include the formulation of operational rules and regulations which are primarily concerned with managing recreational users; while yielding the responsibility of

managing land use to the private land owners (Oklahoma Scenic Rivers Commission, 1982).

Future environmental quality of the Illinois River is an issue of current concern and controversy. A variety of land uses have produced significant environmental degredation along the river (Etter, 1982; Fink, 1981; Garrity, 1981; Lantz, 1978; Northeasten State University, 1981; Oklahoma Tourism and Recreation Department, 1976; Smith, 1974; U.S. Bureau of Outdoor Recreation, 1976; U.S. Department of Interior, 1978). Though concerns about land use change and the O.S.R.C.'s lack of willingness to influence this change have been voiced, little information has been provided which documents these changes in land use and environmental quality through time. This paper examines the changing patterns of land use adjacent to the Illinois River in an attempt to gauge changes in the quality of the river environment, and, to weigh the effectiveness of Oklahoma's river protection program, which includes the Scenic Rivers Act and Scenic Rivers Commission, as an independent mechanism enforcing the Scenic Rivers Act's long term environmental protection objectives.

Study Objectives

Three research objectives are set forth in this thesis. The first two include the identification of

changing patterns of land use adjacent to the river and relating these changes to expected outcomes of different resource management situations. These objectives are addressed in the analysis section of this thesis. The third objective is to identify the effects which might result from the imposition of a new management situation. This objective is discussed in the conclusions of the analysis.

CHAPTER II

RELEVANCE OF THIS STUDY

A Sample of the Geographic Literature Concerned With Man-River Relations

This research effort is concerned with man's interactions with his environment, and is consistent with the man-environment theme in geographic thought. Geographers have examined relationships between man and rivers from various perspectives, and the following are some examples of the more prominent viewpoints that have been adopted.

Huntington (1927) and Semple (1911) examined man river relationships from an environmental deterministic viewpoint. These authors considered rivers as one of many environmental factors which determine human behavior. For example, rivers are seen as factors which determine where settlements locate. From this viewpoint a navigable river is seen as an asset to settlement, while an unnavigable river is perceived as a factor which hinders settlement.

Defining rivers as economic resources is a common perspective from which man-river relationships are

examined. Dewhurst (1947), Lippincott (1929), Whitbeck and Finch (1930), and Jones and Darkenwald (1954) include just a sample of the literature describing the interactions between man's economic activities and river resources. All of these authors describe the role rivers play in economic development.

Understanding man's role in changing the face of the Earth became a concern of geographers after Marsh's seminal work: The Earth As Modified By Human Action. (1898). Since the turn of the century a substantial body of knowledge has been accumulated which describes various effects of man's activities on rivers and river environments. Examples of such research include works by Graf (1979), Halprien (1980), Leopold (1956), and Thomas (1956).

White (1956) significantly changed the course of man-environment research. He turned from the descriptive approach to one which identifies and explains the mechanisms behind existing man-environment relationships. White's research, which focused on the urban uses of flood plains, was the catalyst for research by Burton (1962), Kates (1962), and White (1961 and 1964), all of which seek to understand the mechanisms influencing man's relationships with rivers and river environments.

This thesis follows the research tradition founded by White. It seeks to explain man's relationship with the

Illinois River environment, and examines the observable outcomes of several management mechanisms.

Rivers As Recreational Resources

Until recently, traditional river management objectives, which involve development, prevailed in our society (Alexander, 1977). These objectives reflected society's perceptions of rivers as uncontrollable nuisances, which need to be domesticated in order to serve the desires of man (Nash, 1977). Such domestication has altered the biological, chemical, and physical characteristics of many rivers to extents unknown by previous generations (Mrowka, 1978). If these actions were allowed to continue unchallenged, then it is conceiveable that free-flowing rivers, as past generations knew them, would disappear from the landscape (Peters, 1975). To some, this notion was unacceptable and they became involved in efforts challenging traditional river management objectives.

Since the early 1960's broad segments of society have called for protection of the nation's remaining free-flowing rivers. Initially, these calls were made by members of the ecology movement, and later by recreationists who began to define rivers as recreational resources in a nation where such resources are in diminishing supply (Sumner, 1976). Nash (1977) outlined

five reasons for the emergence of concern about the fate of free-flowing rivers and the increased popularity of river recreation: (1) the ending of the American frontier, (2) changes in environmental attitudes, (3) population shifts from rural to urban areas, (4) appreciation of rivers as refuges from urban environments, and (5) improvements in river running technology, which lowered costs and improved safety of river recreation.

The massive increase in river recreation during the 1970's lent considerable support to the calls for river protection. However, this popularity also led to a number of environmental and social problems (Craighead, 1965; Driver and Bassett, 1973; Goetz, 1977; Goodall, 1978; Peters, 1975). Environmental problems are related to overuse of rivers by recreationists, and include erosion from make-shift accesses and campsites, solid waste accumulation, recreation facility construction, and degradation of water quality (Craighead, 1965; Driver and Bassett, 1973). Social problems arise from the conflicts between those who wish to develop rivers, and river environments, with those who seek to protect the natural and recreational qualities of river environments (Assmunsen and Bouchard, 1970). In the following section, methods of managing rivers to maintain natural and recreational qualities are discussed.

Survey of Literature Concerned With Recreational River Management

Research concerned with recreational rivers has been conducted within various disciplines which include biology, economics, environmental studies, forestry, geography, landscape architecture, law, recreation, and sociology. The breadth of this research is exemplified in an annotated bibliography by Anderson, Leatherberry, and Lime (1978). This bibliography describes over 250 research articles covering six major areas of inquiry: (1) the role of river resources in outdoor recreation, (2) river inventory and classification methods, (3) economic evaluations of river recreation, (4) investigations of environmental impacts of recreation use, (5) identification of use, user patterns, and user perceptions, and (6) management of river resources.

After surveying the literature concerned with recreational river management, it is apparent that there are two major thrusts to contemporary management practice. These are the management of recreational and nonrecreational users of riparian environments. Most of the literature associated with recreational river management deals with recreational use. This is because research has concentrated on Western rivers, managed within the jurisdictions of National Wild and Scenic Rivers, National Parks, or National Monuments (Lime,

1977). In these settings, nonrecreational riparian uses are of little or no consequence to environmental quality when compared to overuse by recreational users. Thus, management and research justifiably focus on recreational use. However, in settings where management goals are determined by several interests, the management of nonrecreational riparian uses becomes more critical (Peters, 1975).

Managing river corridors to meet environmental protection objectives almost always involves some type of land use control. This situation is not a major problem when a river designated for protection flows through public lands; but it becomes a major problem when a designated river flows through long stretches of land in private ownership (Eastman, 1977). Lucas (1977) explains the complexity of this problem:

> Rivers are embellished in an intricate web of mixed legal jurisdictions, management responsibilities, diverse ownership, and conflicting recreational and commodity users (p. 418).

Assmunsen and Bouchard (1970) discussed the Federal Wild and Scenic River Act as a mechanism to protect and preserve a selection of the nation's remaining free-flowing rivers. They contended that this act challenges private property rights because it includes mechanisms for the acquisition of lands held by private owners. The

authors suggested that rivers designated for protection in areas where much of the land is in private ownership stimulate strong local opposition and incur high costs of property acquisition, thus dampening the act's effectiveness. The authors also noted that most designated Federal Wild and Scenic Rivers flow through public lands, a situation which is attributed to the government's attempt to avoid these problems.

Eastman (1977) examined the status of the National Wild and Scenic Rivers System and found that most of the system's river miles are located in Western states, which are inaccessible to the majority of potential recreational users. Eastman contended that to change this distribution, more rivers would have to be designated in areas where most of the land is in private ownership. However, he concluded that purchase of extensive tracts of private land is socially and economically undesirable, and advocated other methods of land use control such as creation of scenic easements or zoning regulations.

Goodall (1968) compared the Oregon Scenic Waterways Act with the Federal Wild and Scenic Rivers Act in terms of effectiveness in balancing private and environmental interests. He concluded that the Federal Act has stronger methods for protecting designated rivers, but is not as sensitive to private interests as the Oregon Act. As an alternative to the Federal program, Goodall recommended

that state river protection programs should be developed which include aggressive land use controls to coordinate, but not eliminate, private interests from the river corridor.

Moss (1976) compared the Federal Wild and Scenic Rivers Program with the New York State Wild, Scenic, and Recreational River Program. The two programs were determined to be similar in that they both include classifications of rivers based on degree of development. However, they differed in respect to land use controls, with the New York system lacking a land use regulatory framework on the state level. To minimize local opposition and costs of land acquisition, the author advocated the use of local zoning or other land use regulations guided by state agencies to manage river corridors.

Doehne (1977) explained Michigan's river protection program as one which concentrates its efforts on managing land use. The author believed that such action is justified because of the permanent environmental consequences associated with land development. To lessen potential conflict between private landowners and public environmental objectives, land use regulations are developed through public involvement processes.

Alternatives to the fee title purchase of lands as a mechanism to control land use were discussed by Priestnitz and Harrison (1977). The authors believed that zoning is

an inadequate tool for land use control because it must be backed with the threat of acquisition, which is controversial and often cost prohibitive. Development of scenic easements which involves the purchase of property development rights while leaving the land in private ownership was their recommended alternative. The authors concluded that this alternative is less costly, more acceptable to local interests, and more permanent than zoning ordinances or other regulatory policies.

Branch and Fay (1977) examined the use of a scenic easement for maintaining the environmental qualities of a river flowing through private lands. This case study concluded that the scenic easement is an effective tool for managing land use along the river. However, the success of this program is clearly related to the fact that the entire river corridor is under the ownership of a single lumber company. In circumstances where land ownership is diffused among multiple interests, successful implementation of a similar program is likely to be more difficult.

Goetz (1977) described a cooperative approach to river management used to protect Montana's Blackfoot River. This approach involved compromise among government agencies, corporate timber owners, ranchers, and private land owners. The result of this compromise was the establishment of a scenic easement, administered through

local management. Goetz concluded that the cooperative approach is an effective management mechanism for protecting the river corridor. However, he warned that this approach might not be appropriate in other situations, where the various land owners and managers have less compatible resource management strategies and objectives.

Through review of articles concerned with recreational river management and from personal correspondence with river managers, Alling (1977) identified several major obstacles to the creation of state-level river protection programs. Among these obstacles was the opposition from local riparian land owners, especially along rivers where a high proportion of the lands within the river corridor are owned by private interests, and the lack of a visable constituency supporting river protection. He concluded that state river protection programs with centralized control are neither the most acceptable nor practical mechanisms for management. He recommended that alternative mechanisms be devised which emphasize local control augmented with state guidance for program implementation. The importance of a strong supporting constituency was also stressed as a key to the success of state river protection programs.

Summary

Management of nonrecreational riparian uses is critical if any river protection program is to succeed. Such management is almost always accomplished through some type of land use control or administrative mechanism.

The Federal Wild and Scenic River System initially addressed management control through private property acquisition, or by designation of streams flowing through public lands. However, these practices have been unsuccessful at creating a system readily accessible to the majority of potential recreation users. This situation is of major consequence to the effectiveness of state river protection programs, which lack both the land and the monetary resources needed to control land use along designated rivers. In summarizing the problem of managing rivers in multiple ownership, Moeller (1977) states:

> Managing rivers in multiple ownership is an exceedingly difficult job..... especially since a single weak or missing link will cause failure of the entire system (p. 414).

The literature displays a changing trend in the philosophy of managing rivers within multiple ownership corridors. The strategy of forced coercion through property acquisition and zoning restrictions has given way to methods of cooperation, such as the establishment of

scenic easements, coordinated by local interests. This change has come about to alleviate both the high costs of land acquisition and the opposition from local riparian landowners.

For cooperative arrangements to work, all land owners must surrender some of the ownership rights associated with development. Though cooperative arrangements have been implemented with success, it has been mentioned that such approaches are not always appropriate solutions to management problems. Cooperative management mechanisms can be used to serve the self interests of local landowners (Alling, 1977; Goetz, 1977; Moeller, 1977). If such a situation arises, the objectives of the river protection program are jeapordized and alternative management strategies must be identified and implemented.

Much of the literature surveyed discussed mechanisms used to maintain the quality of riparian environments through land use control or coordination programs. Unfortunately, none of these articles examined the impacts of these management programs, either in terms of effectiveness in influencing land use patterns along protected rivers, or in terms of achieving river protection objectives. Such feedback is absolutely critical for effective resource protection programs (Ditton, Schmidly, Boer, and Graete, 1977). This is especially true in situations where cooperative management

strategies have been implemented and the danger of local manipulation by self interests exists.

This paper examines the effectiveness of a cooperative program designed to manage nonrecreational riparian land users with the purpose of meeting environmental protection objectives. The relationship between policy and landscape is examined, in an attempt to illustrate the environmental consequences which can occur when a cooperative management program, devised to protect a river resource, is manipulated to serve local interests.

CHAPTER III

METHODOLOGY

Delineation and Description of the Study Corridor

The study corridor includes ninety-seven kilometers of Oklahoma's section of the Illinois River. This section stretches from the Lake Fracnces Dam near the Oklahoma-Arkansas border to the 195 meter elevation mark near Tahlequah, Oklahoma, which delineates the maximum flood pool of Tenkiller Ferry Reservior (Figure 1). The length of the study corridor is consistent with the river segment designated for protection by the Oklahoma Scenic Rivers Act. The width of the corridor extends to a minimum distance of 1600 meters from each river bank. This width includes all of the Illinois River Valley along the study segment. Thus, the study corridor contains all lands affecting environmental quality of the Illinois River.

The study corridor is located in northeastern Oklahoma and includes portions of Adair, Cherokee, and Delaware counties. This area lies within a state tourism region referred to as Oklahoma Green Country. This region is typified by abundant woodlands and water resources,

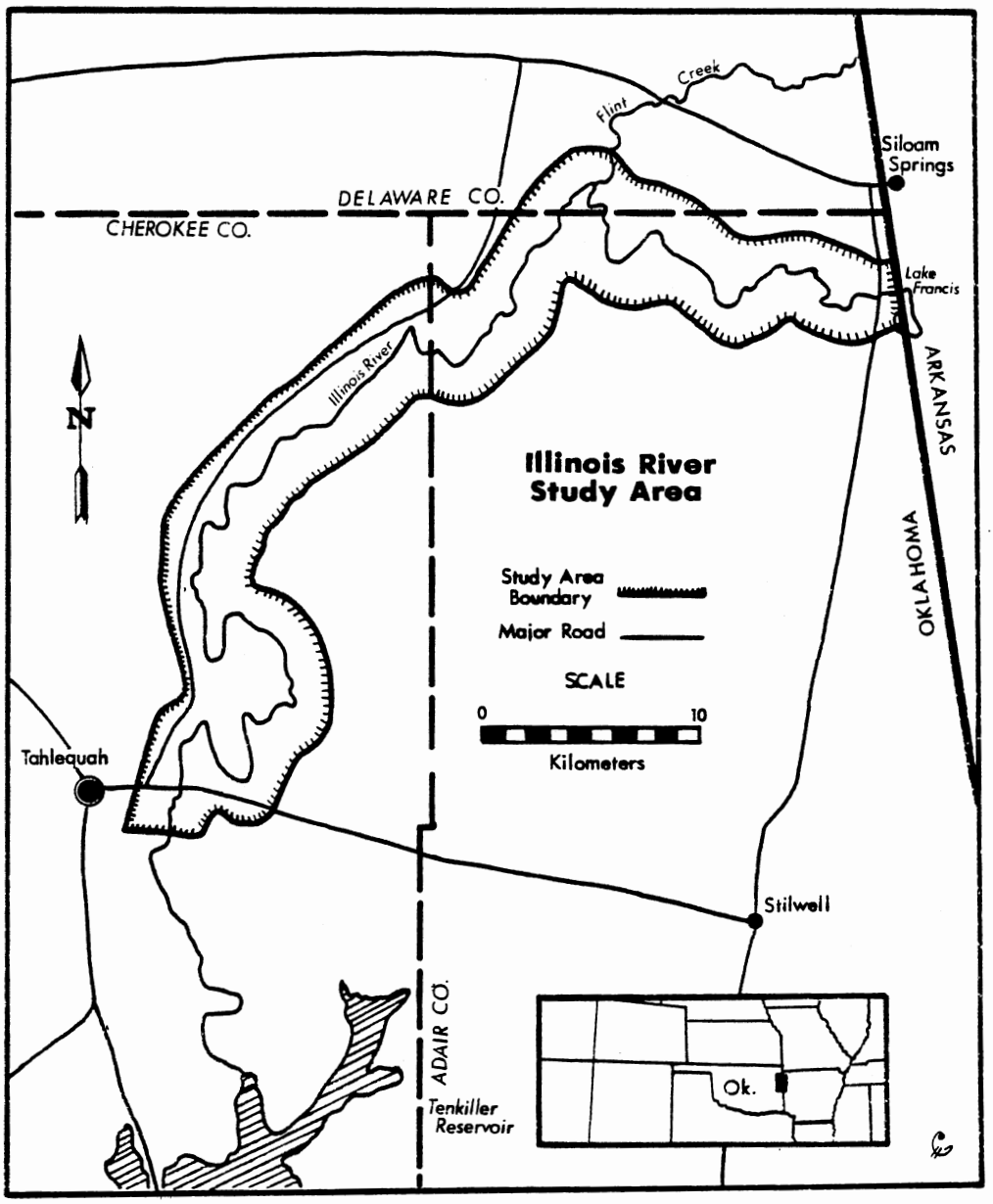


Figure 1. The Study Corridor

which makes it unique in a state with few such resources for recreation.

Physical Characteristics

The Illinois River flows through the southeast fringe of the Springfield Plateau, which lies within the Ozark Uplift Physiographic Province. The Springfield Plateau is composed of rolling upland areas deeply dissected by V-shaped stream valleys. Large cliffs are common features along the Illinois. These cliffs result from the river's downcutting through sedimentary layers of limestone, sandstone, and shale (Starke, 1961).

The presence of these cliffs has resulted in a valley width that varies considerably within the study corridor. Of significance are narrow areas where roads are either constricted to areas adjacent the river or are forced to far removed areas. In the former case development tends to locate along the river, while in the latter it tends to be removed.

Population

Population of the area within and near the study corridor was 10,413 during 1980. Of this population one hundred percent are classified as rural (U.S. Bureau of Census, 1982a). The largest communities within the vicinity of the study corridor include Tahlequah, Oklahoma

and Siloam Springs, Arkansas, which had respective 1980 populations of 9,450 and 7,370 (U.S. Bureau of Census, 1982b). Tahlequah has had the only impact on land use within the study corridor. It has generated residential growth along the river's west bank within the extreme southern portion of the study corridor. The population of this three county region increased by twenty-seven percent from 1960-70 and by thirty percent from 1970-80 (Table I).

Economic Activities

Agriculture continues to be the dominant economic activity within the Illinois Valley. In terms of dollar value, hay and beef production are the most prosperous activities practiced, followed by nurseries, poultry production, dairies, and orchards. Row cropping is practiced to a limited extent with green beans, soybeans, and wheat being the major crops (U.S. Department of Interior, 1978).

During the 1970's the popularity of river based recreation exploded. This popularity affected the Illinois River as recreationists began to flock to its waters. As a result, recreation enterprises sprang up along the river to serve the needs of these recreationists. From 1970 to 1975, the number of canoes rented per season jumped from approximately six hundred to over thirty-six thousand (U.S. Bureau of Outdoor Recreation, 1976). As of 1978,

TABLE I

POPULATION CHANGE: 1960-1980

County	1960	1970	1980
Adair	13,112	15,141	18,525
Cherokee	17,762	23,174	30,634
Delaware	13,198	17,767	23,946
Total	44,072	56,083	73,205
Percent Change	60-70	70-80	
	22%	30%	

Source: U.S. Bureau of Census, 1980 Census of Population, 1982b.

twenty-five canoe liveries were in operation along the river with the capacity to rent as many as 2500 canoes during a single day (U.S. Department of Interior, 1978).

The three counties through which the Illinois River flows are among those with the lowest per capita incomes in Oklahoma (U.S. Bureau of Census, 1982a). Thus, the study area is situated in a region which can be classified as economically depressed.

Accessibility

In this study accessibility is concerned with two factors. The first is concerned with accessibility into the study corridor and includes all roads which offer transportation. The second is related to access onto the river itself and consists of public access points where recreation users can gain legal river access (Figure 2).

Access into the study corridor is provided by numerous paved and unpaved roads. For most of its length the Illinois is paralleled by roads along both banks. Undoubtedly, this accessibility to the river corridor is one of the reasons why the Illinois is so attractive to recreationists and developers alike. Accessibility to the river is provided at four state owned public access sites as well as at five bridge locations. Most of these access points are located in Cherokee County and all are adjacent to paved roads. These accesses are frequented by various

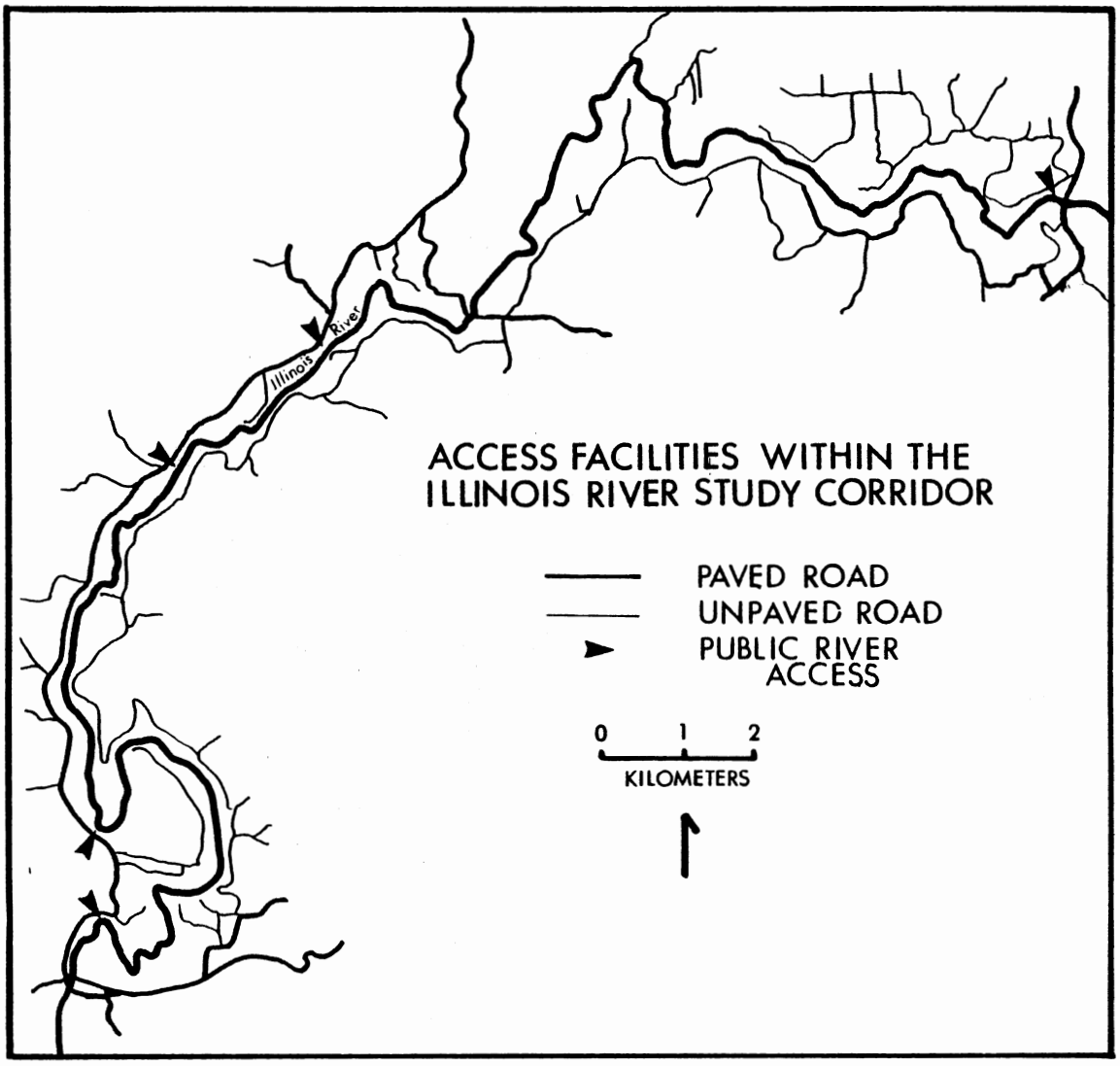


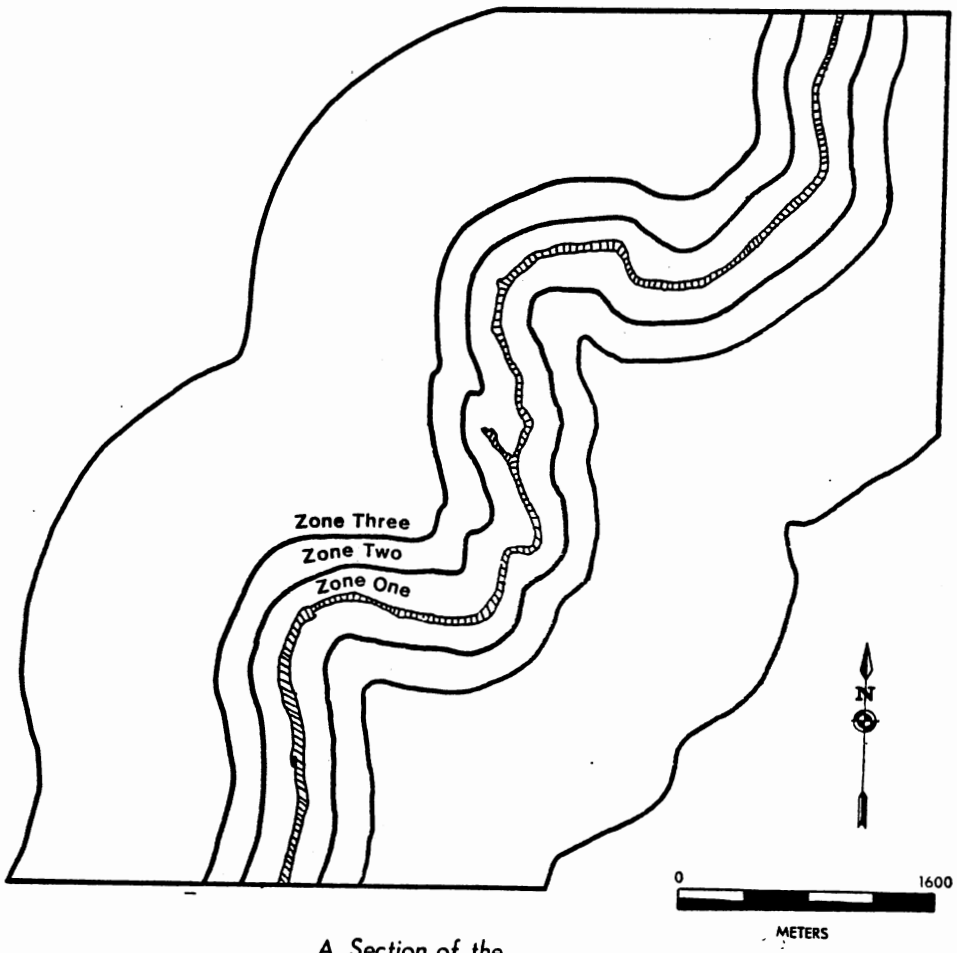
Figure 2. Access Facilities Within the Study Corridor

types of recreationists including campers, canoeists, fishermen, and swimmers. They are also heavily used as drop-off points by canoe livery operators.

Study Area Subdivisions

In order to organize the data in a manner which affords analysis to meet the study objectives, the study corridor is subdivided into three zones based on distance from the river banks (Figure 3). Zone one extends from the river banks to a distance of at least 200 meters. This distance includes areas adjacent to the river and approximates the corridor width under jurisdiction of the Oklahoma Scenic Rivers Commission. Zone two extends from 200 to 400 meters from the river banks, and includes areas within close proximity to the river. The total area within zones one and two approximates the corridor width utilized by federal agencies to manage National Wild and Scenic Rivers. Zone three extends from 400 to 1600 meters from the river banks and includes the rest of the area within the study corridor. The area within all zones represents the total area of the Illinois River study corridor.

Dissecting the study corridor into distance zones provides information pertaining to where land use changes are occurring in relation to the river. This information is important because developments within zones one and two have greater impacts on the river environment than if they



A Section of the
Illinois River Study Area
Depicting the
Distance Zones

Figure 3. Distance Zones

are located in zone three. Examining rates of land use change within distance zones also allows comparison between observed changes and changes expected under different resource management situations. For example, when comparing observed changes and expected changes associated with National Wild and Scenic River management, concern is focused within zones one and two because the corresponding area represents the approximate corridor which would be managed under the Federal system.

Data and Collection Methods

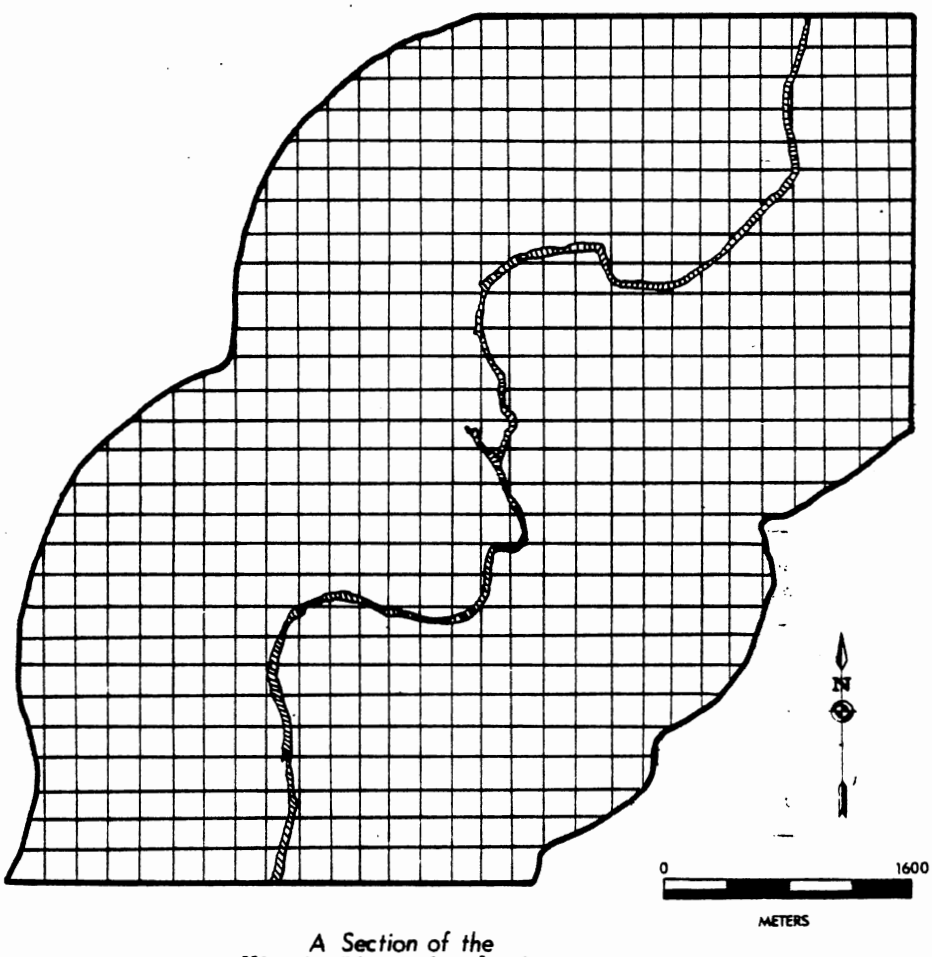
Data Collection Grid

To facilitate data collection and organization, a grid system was developed which partitions the study corridor into 200 meter square cells (Figure 4). This cell size was chosen because it provides high resolution necessary to detect land uses which occupy small spatial units. The 200 meter square cell size also is consistent with the width of the distance zones. Grid cells are referenced with X-Y coordinates and are assigned to distance zones. Each cell is assigned to a specific zone if more than fifty percent of its area lies within a particular zone. Table II identifies the number of grid cells associated with each distance zone.

TABLE II

NUMBER OF CELLS WITHIN
DISTANCE ZONES

Zone	Number of Cells	Percent of Total
One	1122	18%
Two	993	16%
Three	4243	66%
Total	6364	100%



A Section of the
Illinois River Study Area
Depicting the
Data Enumeration Grid System

Figure 4. Data Collection Grid

Data Base

Data for this study include select land uses and all structures within the study corridor. Land uses are classified through use of a modified version of the classification system devised by Anderson, Hardy, and Roach (1972). This system is designed for use with remote sensor systems and includes four levels of classification based on resolution capabilities of different imaging systems. Since this study utilizes air photographs, the Level II classification system is used.

After modifying the classification system to reflect the land use situation along the river and to complement the objectives of this study, the classification system presented in Table III was adopted.

Other modifications include discrimination between residential land uses located within rural residential subdivisions from those which are not. This was done because addition of such developments along the river is a current issue. Commercial land use is also discriminated in this manner because the subdivisions include recreational vehicle park areas which are viewed as commercial areas.

Structures are defined as any building which serves human habitation requirements or which support economic activities. Included under this definition are houses, cabins, mobile homes, barns, poultry houses, outbuildings,

TABLE III

LAND USE CLASSIFICATION SYSTEM

LEVEL I	LEVEL II
1. Built-Up Lands	11. Residential
	12. Commercial
	13. Extractive
	14. Transportation and Utilities
	15. Institutional
	16. Open and Other
2. Agricultural Lands	21. Croplands and Pasture
	22. Nurseries and Orchards
	23. Livestock Feeding Operations
	24. Other Agricultural
3. Forest Lands	31. All Forest Lands

stores. Not included are items such as power poles, antennaes, windmills, etc.

Data Sources

Land use and structure data were inventoried and compiled for the years 1964, 1972, and 1982. The earlier two years were selected because they represent time periods with availible airphoto coverage before and after the Illinois designation as a protected river. The final year was chosen because it includes the contemporary land use situation along the river. Because no 1982 airphoto coverage was available, the contemporary inventory was accomplished through field observation.

Data sources for 1964 and 1972 include Agricultural Stabilization and Conservation Service airphoto coverage for Adair, Cherokee, and Delaware counties. These airphotos have a scale of approximately 1:20,000, which was adequate for the interpretation required in this study. It was also possible to compare the 1972 airphoto coverage with U.S.G.S. Topographic Maps compiled during the same year. Examination of airphotos and maps compiled during different time periods is a common technique used to evaluate land use and environmental changes (Avery, 1968; Lounsbury and Aldrich, 1979; Nobe, 1961).

Data Collection

Presence of select land uses and number of settlement structures within each cell were compiled for each inventory year. Since land use was inventoried in a manner which included all uses present within a cell, it is possible for cells to have more than one use. The only problem with this situation lies with identifying the number of structures associated with a given land use in cells which contain more than one land use associated with development, e.g. residential and commercial. These situations represent the exception rather than the rule, therefore, it is possible to determine approximate structure counts associated with any given land use.

In order to determine grid cell locations on the airphotos and in the field, the data collection grid system was superimposed on 1972 U.S.G.S. Topographic Maps. Locating cell position was accomplished through relating positions of land uses and structures present on the airphotos and landscape with cultural and physical features on the topographic maps. Determining locations for structures straddling two or more cells was accomplished by locating the structure in the cell containing most of the structure. This situation was mainly a problem where livestock feeding operations were present. These uses frequently include long poultry houses which cover two or more grid cells. In these cases the

structures were assigned to one grid cell, while all of the cells with part of the structure were assigned the structures corresponding land use.

Land use and structure data were initally inventoried for 1982. During the field inventory, locations of land uses and structures were checked for presence and location on the topographic maps and 1964 airphotos. This cross referencing helped to insure the accuracy of the field inventory and aided in the interpretation of the airphotos. Following the field work, data were inventoried for 1964 and 1972 through airphoto interpretation. The compiled 1982 data provided a data base which helped to identify the cells which were of interest. This simplified the task of interpretation because locations of land uses and structures were already determined and confirmation of presence or absence during previous years was all that was required.

Analysis of Data

Data are analyzed through two stages which are consistent with the study objectives. In stage one, land use patterns within the study corridor, as well as changes which have occured during the study period are described. These changes are related to expected outcomes of different river management situations in stage two. Situations include: (1) management vested totally with the

private sector; (2) management vested totally with the public sector through the National Wild and Scenic Rivers Program; and (3) management vested in a cooperative arrangement between private and public interests through a properly functioning Oklahoma Scenic Rivers Program.

CHAPTER IV

RESULTS OF ANALYSIS

Stage One

In this stage, land use patterns within the study corridor, as well changes which have occurred during the study period are described. Examination and description of these changing patterns of land use is accomplished through two steps. General land use patterns present within the study corridor during each inventory year are described in step one. Changes in these patterns over the study period are also described. To describe these patterns, a table is presented which identifies the number of cells associated with each use from 1964 to 1982. To illustrate which uses have undergone the most change, land uses are ranked from highest to lowest percent increase during the study period.

In step two, the land uses with the greatest increases are examined in detail to determine where changes are occurring in relation to the river. Chi-squared analysis is used to determine if proportional increases in select land uses differ between distance

zones. This procedure is repeated for structures associated with each land use to determine if proportional increases vary among the distance zones. For both cells and structures, the analysis tests a null-hypothesis of no significant difference between zones in the proportion of increase. Analysis is conducted for both the 1964-72 and 1972-82 time periods.

General Land Use Changes

Table IV indicates the total number of cells occupied by inventoried land uses during each inventory year. Forest, cropland, transportation, and utility land uses occupy the most cells within the corridor during all inventory years. In general, these uses have not increased, with the exception of transportation uses, which increased during the 1972-82 time period. All of this increase was related to road construction within rural subdivisions, thus reflecting increases in residential land uses.

Major land use changes include increases in commercial and residential activities. Increases in these uses are attributed to the area's environmental characteristics, which are amenable to recreation activities (Ullman, 1954). Environmental amenities have lured the recreation oriented public to the river area, making it an attractive place to invest for commercial and

TABLE IV

NUMBER OF CELLS ASSOCIATED WITH SELECT
LAND USES FOR EACH INVENTORY YEAR

Land Use	1964	1972	1982	% Change 64-72	% Change 72-82	% Change 64-82
Commercial	23	48	107	+101%	+123%	+365%
Residential	236	331	862	+40%	+160%	+265%
Livestock Feeding	11	15	31	+36%	+107%	+182%
Nurseries and Orchards	8	8	25	0	+32%	+32%
Transportation and Utilities	2060	2060	2456	0	+19%	+19%
Institutional	20	21	21	+5%	0	+5%
Other Agriculture	310	323	327	+4%	+1%	+5%
Crop and Pasture	2939	3010	2968	+2%	-1%	+1%
Forest	5664	5654	5656	0	0	0
Other Built-up	18	18	18	0	0	0
Extractive	5	5	5	0	0	0

recreational developers. Commercial development has primarily taken place within a small portion of the study area, concentrating in a strip type development along the river's west bank. Exceptions to this pattern are commercial developments within the rural residential subdivisions. These subdivisions include tracts of land used for recreational vehicle parks, as well as other recreational facilities for subdivision residents (Plate 1). Residential land use is dispersed throughout the corridor in a fairly uniform pattern. Exceptions to this pattern are the the rural residential subdivisions and the urban expansion of Tahlequah. (Plate 2).

Other land uses which increased substantially are livestock feeding operations, and nurseries and orchards. These land uses reflect an intensification of the pastoral agriculture traditionally practiced within the Valley. Similar modifications of agricultural practices have occurred in other rural areas where farmers are forced to respond to inflated land values related to residential and commercial development (Crowley, 1975; van Otten, 1980).

Livestock feeding operations are associated with poultry and pork production. These operations have spread throughout the study area, with the highest concentration near Chewey Bridge, along the river's west bank (Plate 3). Nursery land use is a recent addition to the Valley, arising in the mid 1970's. A single nursery operation is

located on the river's west bank (Plate 4). Undoubtedly, this operation located in this area because of the availibility of water and the relatively well developed transportation system. Orchards are an established land use within the Valley. A number of small orchards are scattered throughout the study corridor (Plate 4).

Institutional and other agricultural land uses increased slightly during the study period. Institutional uses consist of a church camp, church grounds, cemeteries, and schools. Plate 5 shows that this type of use is dispersed throughout the study corridor. The church camp probably located in the area because of the recreational amenities, which is reflected by its location adjacent to the river. Churches, cemeteries, and schools are present to serve the local population, thus distribution is tied to accessibility to transportation facilities, rather than the river. Other agricultural uses are composed of lands occupied by farmsteads or related structures such as barns and outbuildings. This use is ubiquitous and is uniformly distributed within the study corridor (Plate 6). Presence of farmsteads illustrates the initial agricultural dominance of land use within the study corridor.

Extractive and other built-up land uses are the remaining classifications inventoried. Though these uses were present, they did not increase during the study period. Thus, these uses continue to occupy a minute

proportion of the study corridor. Extractive uses were concerned with quarrying limestone, though at this time the two areas with operations are inactive. Other built-up lands are represented by public river accesses and other public parklands. Most of these consist of river accesses

Discussion. Commercial, residential, livestock feeding, and nursery and orchard activities accounted for most of the changes in land use from 1964 to 1982. Proliferation of these activities suggests an intensification of land use within the study corridor. Land use intensification translates into an environmental change from a less used and more pristine quality, to a more used and less pristine quality.

This trend of land use change also signifies transition from a bucolic landscape to a mottled landscape, containing bits and pieces of both the rural and urban character. In this situation, pieces of the urban landscape include strip and cluster developments related to commercial activities, as well as non-farm residential developments within and outside of rural subdivisions.

Increases in livestock feeding operations and the addition of the nursery indicate a changing trend from pastoral agriculture to more intensive practices. Intensification of agriculture also contributes to alteration of the landscape as structures and roads are built to support such operations.

Though these changes in themselves indicate environmental alterations, the location of change in relation to the river is of utmost concern. This is because changes close to the river magnify the problems which affect the river environment. During the following pages, it is examined where increases in the presence of residential, commercial, livestock feeding, and nursery and orchard land uses are occurring in relation to the river.

Commercial Land Use Change

General Description. For the most part, commercial activities exist to provide recreation services. These services include canoe livery operations, lodging facilities, restaurants, and general merchandise stores. Sophistication of these range from aluminum buildings, with posterboard signs, to elaborate motel facilities, complete with swimming pools and water slides.

From a recreational river management standpoint, commercial operations are both assets and liabilities. They are assets as providers of opportunity for the vast majority of recreational river users. In the Illinois' case, this statement is supported by the fact that over ninety percent of the river floaters use equipment and services provided by commercial canoe liveries (Hecock and Tweedie, 1980). Liabilities are environmental disruptions

caused by commercial development and operations. Among the most obvious disruptions are alteration of the environment's natural character and visual blight associated with structure development (Fitzsimmons, 1979; Kariel and Kariel, 1982; Todhunter, 1981).

Visual blight and alteration of the environment's natural character are related, in that one results in the other. Visual blight can be regarded as a value judgement, though it is hard to defend water slides, signs overhanging the river, and buildings adjacent to the river as contributors to the natural character of the environment (Lewis, Lowenthal, and Tuan, 1973).

Other environmental problems connected to commercial activities include the handling of human and solid wastes. Commercial operations are in business to make a profit, and in order to do so they must attract recreationists at a mass scale. Other than money, recreationists often bring things to the river environment that they do not always bring out (Samdahl, Christensen, and Clark, 1982). In this case, human waste is not an obvious problem like solid waste. Solid wastes frequently accumulate at access points and river segments requiring better than minimum skills to navigate. Accumulation of non-intoxicating malt liquor aluminum containers is the most noticable solid waste problem. In some places, the river bottom shines with the concentration of these containers.

A final problem worth considering is the pressure put on the local transportation system by commercial operations. These operations usually include the mass transportation of equipment and recreationists to and from river access points. Large, slow moving vehicles pulling long trailers, many capable of holding twenty-four canoes, move along the Valley's narrow and winding roads, thus creating potentially hazardous driving situations. Use of public river accesses by commercial operators for loading and unloading causes disruption which has been documented as causing conflict with other, non-outfitted recreationists (U.S. Bureau of Outdoor Recreation, 1976).

Examination of the Increase. Figure 5 illustrates that commercial land use has increased almost four-fold during the study period. In relation to the river, most of this increase occurred within zone one, which is probably related to the surge in river recreation during the 1970's.

Tables V and VI include the chi-squared tables used to determine if proportion of increase in commercial land use differed between zones. Results of this analysis indicate that differences existed between zones for both the 1964-72 and 1972-82 time periods. Further inspection of these tables demonstrate that zone one had more cells converted to commercial land uses than expected. This means that areas adjacent to the river absorbed a

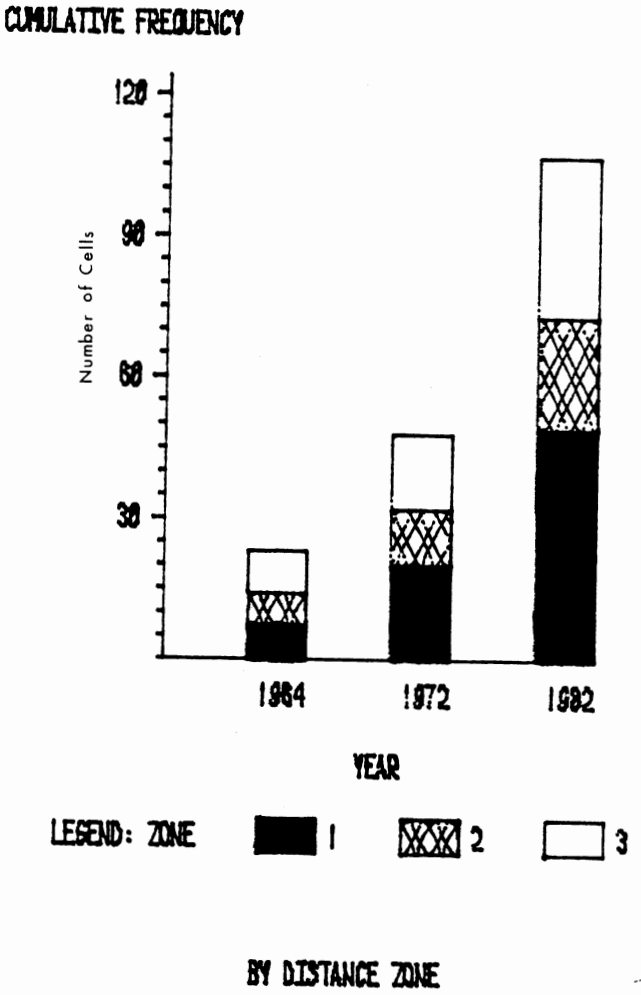


Figure 5. Commercial Land Use Change

disproportionately large share of the increase in commercial land uses during the study period.

Similar results were found in connection with the increase of commercial structures. Results of chi-squared analysis prove that disparity exists between zones in the increase of commercial structures for both time periods (Tables VII and VIII). Examination of the tables demonstrates that zone one experienced more of an increase than expected, thus it received a disproportionate share of the commercial structure increase.

Discussion. During the study period proliferation of commercial land use was evident, with areas adjacent to the river absorbing a large disproportionate share of the increase. This pattern was consistent for both increases in the number of cells and structures. Commercial operations probably locate near the river for two reasons; (1) to maximize benefits from aesthetic values of the river, and (2) to lower costs of moving equipment and recreationists to and from the river. Aesthetic values are what lure recreationists to the river in the first place. Thus, locating next to it probably gives commercial operations some competitive advantage. In regard to lowering costs, locating on the river means that transportation is only necessary in one direction. This direction is usually up river, as most outfitted floats on the Illinois terminate at the location of the commercial outfitter.

TABLE V

CHI-SQUARED ANALYSIS TABLE-CHANGE
IN THE NUMBER OF CELLS
FROM 1964 TO 1972

	Observed	Percent of Area	Expected
Zone One	13	18%	4.5
Zone Two	5	16%	4
Zone Three	7	66%	16.5
Total	25	100%	25

$X^2 = 10.63$*

df = 1

Level of Significance = 3.84 (at 5% level)

Since X^2 is greater than 3.84, the null hypothesis of no proportional difference is rejected at the 5% significance level.

*Because expected values for zones on and two are less than five, they are combined to achieve the requirements for calculating the chi-squared statistic

TABLE VI

CHI-SQUARED ANALYSIS TABLE-CHANGE
IN THE NUMBER OF CELLS
FROM 1972 TO 1982

	Observed	Percent of Area	Expected
Zone One	29	18%	10.44
Zone Two	12	16%	9.28
Zone Three	18	66%	38.28
Total	58	100%	58

$X^2 = 44.52$

df = 2

Level of Significance = 5.99 (at 5% level)

Since X^2 is greater than 5.99, the null hypothesis of no proportional difference is rejected at the 5% significance level.

TABLE VII

CHI-SQUARED ANALYSIS TABLE-CHANGE IN THE NUMBER OF STRUCTURES INCREASED FROM 1964 TO 1972

	Observed	Percent of Area	Expected
Zone One	34	18%	13.14
Zone Two	14	16%	11.68
Zone Three	25	66%	48.18
Total	73	100%	73

$X^2 = 44.73$

df = 2

Level of Significance = 5.99 (at 5% level)

Since X^2 is greater than 5.99, the null hypothesis of no proportional difference is rejected at the 5% significance level.

TABLE VIII

CHI-SQUARED ANALYSIS TABLE-CHANGE IN THE NUMBER OF STRUCTURES INCREASED FROM 1972 TO 1982

	Observed	Percent of Area	Expected
Zone One	46	18%	21.06
Zone Two	32	16%	18.72
Zone Three	39	66%	77.22
Total	117	100%	117

$X^2 = 57.87$

df = 2

Level of Significance = 5.99 (at 5% level)

Since X^2 is greater than 5.99, the null hypothesis of no proportional difference is rejected at the 5% significance level.

Commercial operations and activities are related to a number of environmental disruptions. Most of the problems related to recreation use are not permanent, and can be dealt with through administrative policies and technical mechanisms (Magill, 1977). However, disruption caused by the developments themselves are of more permanent consequence, and are difficult to correct or eliminate once produced(Doehne, 1977). Thus, commercial land uses threaten the natural character of the river environment, for no matter how well planned, commercial developments cannot avoid altering the environment to some extent.

This discussion is not intended to dispute the role of commercial enterprises in the operation of the Illinois as a recreational river, for their importance cannot be denied. What is questioned is why these operations cannot be located in areas farther removed from the river. This undoubtedly would cause inconvenience to some, but the benefits in the form of a more pristine and natural river environment would be of benefit to all.

Residential Land Use Change

General Description. As in other rural areas, non-farm related residential development is a current land use trend along the Illinois River (Brown, 1972; Crowley, 1975; Honroe, 1962; Platt, 1973; Smit and Flaherty, 1981; van Otten, 1980; and Watson, 1979). Residential

architecture is varied. Included are large brick homes, modest frame dwellings, Ozark style cabins, and mobile homes. Establishment of two rural subdivisions, Flint Ridge Estates and Illinois River Ranch, also represent a land use trend common to rural areas perceived as possessing environmental and recreational amenities (Brown, 1972; Johnson, 1973; Parsons, 1972; Stephenson and Nishida, 1979).

Residential land use by no means dominates the landscape along the Illinois River. However, many of the more scenic areas of the study corridor are disturbed by the presence of residential development (Garrity, 1981). In many areas, houses or mobile homes line the cliff tops and other shoreline areas of the river. Such development not only disrupts the river environment's natural character, but can affect water quality as well. The relationship between water quality and residential development is recognized when the problems of managing human wastes are realized. In effect, the more residential development, the higher probability that water quality will be adversely affected. This is especially critical in areas within close proximity to the river.

Examination of the Increase. During the study period the number of cells with residential land uses increased within all distance zones (Figure 6). The rate of increase from 1972-82 far exceeded that of 1964-72 with

the two rural residential subdivisions accounting for this disparity.

In examining residential use increases within the distance zones, contrasting proportions of increase were found between the inventory periods. Results of chi-squared analysis used to assess the proportional increase for each zone from 1964-72 indicates no significant difference between zones (Table IX), whereas those for the 1972-82 period suggest a definite difference (Table X). Comparison of observed with expected increases for the latter period shows that zone three experienced a large disproportionate share of the residential growth. But, when cells located within the rural residential subdivisions are omitted, the results indicate that no zonal difference exists (Table XI). These results denote that the rural residential subdivisions significantly influenced the pattern of residential land use within the study corridor because most of the increase occurred in areas removed from the river.

As can be expected from the increase of cells occupied by residential land uses, the number of residential structures also increased. In contrast to the zonal distribution of the cell increase, chi-squared analysis indicates zonal disparity in structure increase for both time periods (Tables XII and XIII). Examination of the chi-squared tables shows that zone one experienced

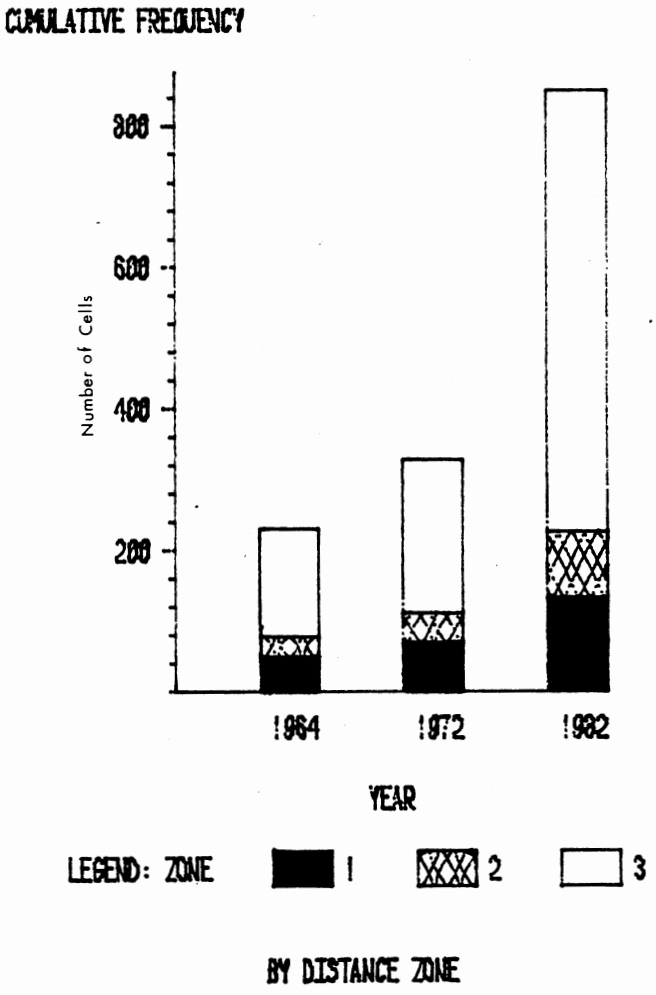


Figure 6. Residential Land Use Change

TABLE IX

CHI-SQUARED ANALYSIS TABLE-CHANGE
IN THE NUMBER OF CELLS
FROM 1964 TO 1972

	Observed	Percent of Area	Expected
Zone One	17	18%	17.1
Zone Two	14	16%	15.2
Zone Three	64	66%	62.7
Total	95	100%	95

$X^2 = .127$

df = 2

Level of Significance = 5.99 (at 5% level)

Since X^2 is less than 5.99, the null hypothesis of no proportional difference is accepted at the 5% significance level.

TABLE X

CHI-SQUARED ANALYSIS TABLE-CHANGE
IN THE NUMBER OF CELLS
FROM 1972 TO 1982

	Observed	Percent of Area	Expected
Zone One	64	18%	95.4
Zone Two	50	16%	84.8
Zone Three	416	66%	349.8
Total	530	100%	530

$X^2 = 37.15$

df = 2

Level of Significance = 5.99 (at 5% level)

Since X^2 is greater than 5.99, the null hypothesis of no proportional difference is rejected at the 5% significance level.

TABLE XI

CHI-SQUARED ANALYSIS TABLE-CHANGE IN THE NUMBER OF CELLS FROM 1972 TO 1982 EXCLUDING CELLS WITHIN RESIDENTIAL DEVELOPMENTS

	Observed	Percent of Area	Expected
Zone One	19	18%	14.9
Zone Two	14	16%	13.3
Zone Three	50	66%	54.8
Total	83	100%	83

$X^2 = 1.59$

df = 2

Level of Significance = 5.99 (at 5% level)

Since X^2 is less than 5.99, the null hypothesis of no proportional difference is accepted at the 5% significance level.

TABLE XII

CHI-SQUARED ANALYSIS TABLE-CHANGE IN THE NUMBER OF STRUCTURES FROM 1964 TO 1972

	Observed	Percent of Area	Expected
Zone One	61	18%	47.3
Zone Two	36	16%	42.1
Zone Three	166	66%	173.6
Total	263	100%	263

$X^2 = 5.18$

df = 2

Level of Significance = 5.99 (at 5% level)

Since X^2 is less than 5.99, the null hypothesis of no proportional difference is accepted at the 5% significance level.

TABLE XIII

CHI-SQUARED ANALYSIS TABLE-CHANGE IN THE NUMBER OF STRUCTURES FROM 1972 TO 1982

	Observed	Percent of Area	Expected
Zone One	110	18%	85.9
Zone Two	90	16%	76.3
Zone Three	277	66%	314.8
Total	477	100%	477

$X^2 = 13.76$

df = 2

Level of Significance = 5.99 (at 5% level)

Since X^2 is greater than 5.99, the null hypothesis of no proportional difference is rejected at the 5% significance level.

TABLE XIV

CHI-SQUARED ANALYSIS TABLES-NUMBER OF RESIDENTIAL CELLS AND STRUCTURES PRESENT DURING THE 1982 INVENTORY YEAR

	Percent Of Area	Cells Observed	Cells Expected	Structures Observed	Structures Expected
Zone One	18%	133	155	312	244.6
Zone Two	16%	94	138	224	217.4
Zone Three	66%	634	569	823	897.0
Total	100%	862	862	1359	1359
X^2 =		Cells = 24.54		Structures = 24.9	
df = 2					
Level of Significance = 5.99 (at 5% level)					

Since X^2 is greater than 5.99 for both cells and structures, the null hypotheses of no proportional difference are rejected at the 5% significance level.

a greater proportion of the increase than expected during both time periods. These results suggest that while increases in cells with residential uses has been either evenly distributed or skewed towards zone three, the intensity of this increase, in terms of structure development, has been greatest in zone one.

This intensity is reflected in Table XIV where the total number of residential cells and structures present in 1982 are summarized for each zone. Results of the chi-squared tests indicate that a difference exists in the proportional distribution of both cells structures. Inspection of observed and expected cell and structure counts indicate that a disproportionate number of cells are located in zone three, while a disproportionate number of structures are located in zone one. These results indicate that the density of residential structures is greatest in zone one, or in areas adjacent to the river.

Discussion. Residential land uses markedly increased along the river during the study period. While this increase appeared to be uniformily distributed between zones, or at least skewed toward areas removed from the river, the intensity of residential development was highest in areas adjacent to the river. This pattern of growth is probably tied to the amenity values of the river, which attracts the residential development. Environmental disruption caused by residential development

threatens the natural character of the environment. These problems magnify as development intensifies, and in the Illinois situation, the greatest intensification is occurring along the river banks.

Building codes, planning standards, and pollution controls can all be imposed to minimize environmental degradation. Such policies, however, cannot totally eliminate environmental disruption. Thus the question is raised as to why this pattern of residential growth has been allowed to occur within an area designated for environmental protection.

Livestock Feeding Land Use Change

General Description. Livestock feeding operations within the study corridor are associated with poultry and pork production. These operations include long buildings used to house chickens, turkeys, and feeder pigs. Poultry houses range in capacity from 8,000 birds for chicken layers, 20,000 for chicken broilers, and 30,000 for turkey (U.S. Department of Interior, 1978). Usually, a poultry farm includes between two and four houses. Hog houses are located within one large operation which lies in the upper stretches of the corridor (Plate 3). This operation includes sixteen houses with a total estimated capacity of 5,000 feeder pigs (Inman, 1982).

Livestock feeding operations threaten the integrity of the river environment because development of structures and production operations alter natural characteristics and affect air and water quality. Presence of structures detracts from the natural setting thereby degrading the recreational amenity values of the river. Degradation of air quality is also a problem, especially when temperature inversions trap stagnant air, leaving a foul odor throughout much of the valley. Threats to water quality have been played down, however, presence of feathers in the river leads to the questioning of such claims. Air and water problems seem to be most noticeable in the areas near Chewey Bridge (Plate 3), where poultry operations have clustered.

Feeding operations also cause problems within the transportation system of the area because large trucks are used to transport livestock, feed, and wastes along the narrow, winding roads. Transporting poultry also poses an aesthetic problem as feathers tend to accumulate along roadsides.

Examination of the Increase. Cells containing livestock feeding operations increased slightly from 1964-72 and more than doubled from 1972-82 (Figure 7). Because of the small increase from 1964-72, it was not possible to meet the neccessary requirements for chi-squared analysis. Thus, no analysis was used to assess

the distribution of increase from 1964-72 for zonal disparities. Chi-squared tables for this period are presented and indicate that the little increase observed was more or less evenly distributed among the distance zones (Table XV).

Chi-squared analysis was used to examine the distribution of increase for 1972-82 (Table XVI). Zones one and two were combined in this case to achieve the required expected value of five for all cells. As in the previous time period, no significant proportional difference between zones was found. However, aggregation of the interior zones mask a disproportionate increase within zone two, which shows up in the chi-squared tables prior to combining the zones (Table XV).

Increase in the number of livestock feeding structures was also minimal from 1964-72. Again, no chi-squared analysis was performed due to the small observed increase. Chi-squared tables for 1964-72 appear to indicate a fairly even distribution of the increase between distance zones (Table XVII). From 1972-82 this situation changed, as the number of livestock feeding structures doubled. Chi-squared analysis indicates that this increase was not proportionately distributed, and the tables denote a greater than expected increase in zone two.

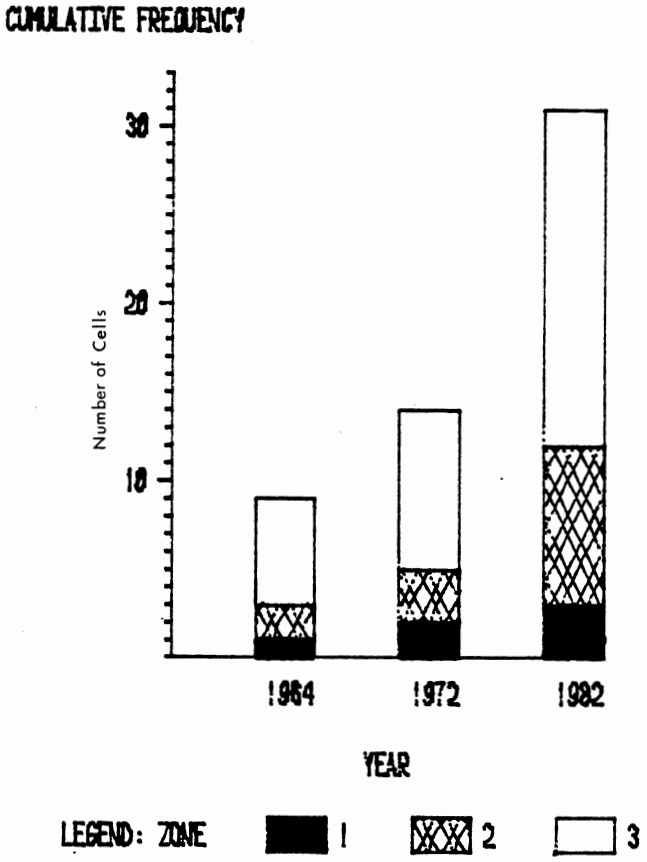


Figure 7. Livestock Feeding Land Use Change

TABLE XV

CHI-SQUARED ANALYSIS TABLE-CHANGE
IN THE NUMBER OF CELLS
FROM 1964 TO 1972

	Observed	Percent of Area	Expected
Zone One	1	18%	.72
Zone Two	0	16%	.64
Zone Three	3	66%	2.64
Total	4	100%	4

Because more than 20% of expected values are less than five, even after combining zones one and two, chi squared analysis cannot be used to generate valid test results.

TABLE XVI

CHI-SQUARED ANALYSIS TABLE-CHANGE IN THE NUMBER
OF CELLS FROM 1972 TO 1982

	Observed	Percent of Area	Expected
Zone One	1	18%	2.88
Zone Two	5	16%	2.56
Zone Three	10	66%	10.56
Total	16	100%	16
$X^2 = .086$*			
df = 2			
Level of Significance = 3.84 (at 5% level)			

Since X^2 is less than 3.84, the null hypothesis of no proportional difference is accepted at the 5% significance level.

*Zones one and two were combined to achieve minimum expected values required for valid chi-squared analysis.

TABLE XVII

CHI-SQUARED ANALYSIS TABLE-CHANGE IN THE NUMBER OF STRUCTURES FROM 1964 TO 1972

	Observed	Percent of Area	Expected
Zone One	1	18%	.72
Zone Two	1	16%	.64
Zone Three	2	66%	2.64
Total	4	100%	4

Because more than 20% of expected values are less than five, even after combining zones one and two, chi-squared analysis cannot be used to generate valid test results.

TABLE XVIII

CHI-SQUARED ANALYSIS TABLE-CHANGE IN THE NUMBER OF STRUCTURES FROM 1972 TO 1982

	Observed	Percent of Area	Expected
Zone One	1	18%	5.9
Zone Two	9	16%	5.3
Zone Three	23	66%	21.8
Total	33	100%	33

$X^2 = 6.72$

df = 2

Level of Significance = 5.99 (at 5% level)

Since X^2 is greater than 5.99, the null hypothesis of no proportional difference is rejected at the 5% significance level.

Discussion. Livestock feeding operations increased in presence during the study period, with areas in close proximity to the river absorbing a higher than expected proportion of the increase. Such development, with related environmental consequences, are definitely undesirable from a river protection perspective. These operations would probably affect the river environment to some degree no matter where they were located within the river valley, but, locating in areas within close proximity to the river amplifies these problems and is even less desireable.

Nursery and Orchard Land Use Change

General Description. Within the study corridor, this type of land use includes a number of small orchards and one nursery. Orchards pose a relatively minimal threat to environmental quality, with the biggest consequence involving the removal of natural vegetation. Use of pesticides in connection with produce production also poses a threat of some consequence.

The nursery involves a more intensive effort, as it requires total removal of natural vegetation, construction of structures and roads, withdrawing irrigation water from the river, and applications of fertilizers and pesticides. This operation can modify environmental quality through the addition of nutrients to the river water. These

nutrients can cause increases in algae, possibly leading to a decrease in the water's oxygen content, a factor which degrades water clarity and affects fish populations (Northeastern State University, 1981). However, possible threats to water quality related to the nursery are currently believed to be minimal (Oklahoma State Department of Health, 1977).

Examination of the Increase. Prior to the 1982 inventory, orchards were the sole representative of this land use classification, as the nursery did not become a part of the land use scene until the mid 1970's. Since the number of orchards did not increase during the study period, no increase in the number of cells occupied by this land use class was recorded. No cells occupied by orchards lie within zone two (Figure 8). This pattern suggests that this land use's impact on the river environment is minimal.

All of the increase in cells from 1972-82 was related to establishment of the nursery. Most of these cells are located in zones one and two, thus chi-squared analysis indicates a difference in the proportion of increase between the distance zones (Table XIX). Increase in structures was also associated with the nursery, thus all increases occurred from 1972-82. Chi-squared analysis shows that this increase was not proportionately distributed (Table XX). These tables illustrate that zone

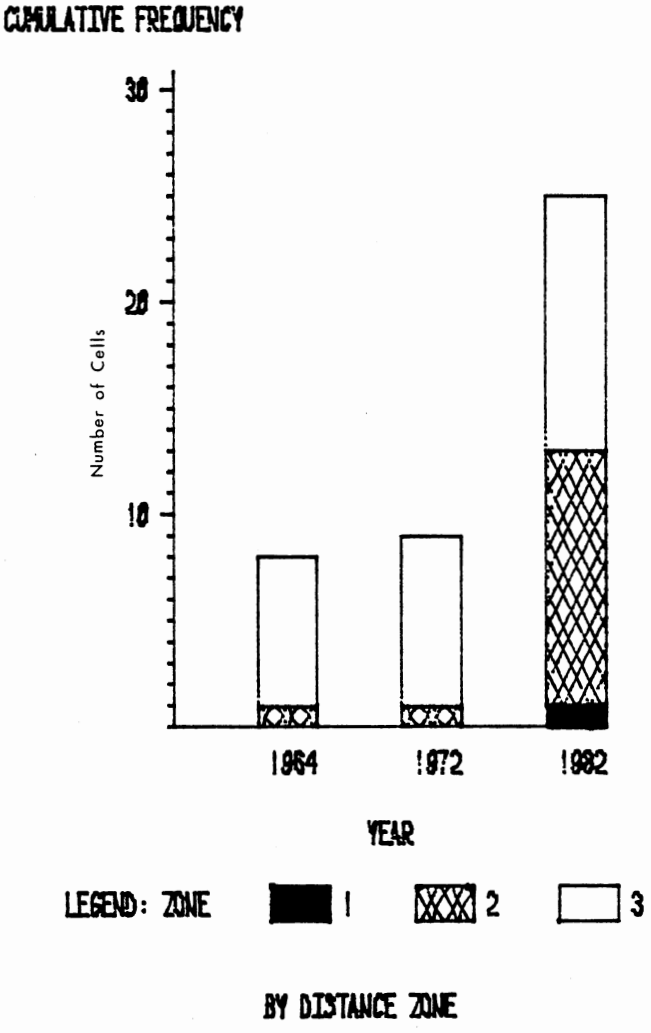


Figure 8. Nursery and Orchard Land Use Change

TABLE XIX

CHI-SQUARED ANALYSIS TABLE-CHANGES
IN THE NUMBER OF CELLS
FROM 1972 TO 1982

	Observed	Percent of Area	Expected
Zone One	1	18%	3.06
Zone Two	11	16%	2.72
Zone Three	5	66%	11.22
Total	17	100%	17

$X^2 = 10.14$*

df = 1

Level of Significance = 3.84 (at 5% level)

Since X^2 is greater than 3.84, the null hypothesis of no proportional difference is rejected at the 5% significance level.

*Zones one and two were combined to achieve minimum expected values required for valid chi-squared analysis.

TABLE XX

CHI-SQUARED ANALYSIS TABLE-CHANGE IN THE NUMBER OF
STRUCTURES INCREASED FROM 1972 TO 1982

	Observed	Percent of Area	Expected
Zone One	0	18%	6.12
Zone Two	14	16%	5.44
Zone Three	20	66%	22.44
Total	33	100%	33

$X^2 = 19.85$

df = 2

Level of Significance = 5.99 (at 5% level)

Since X^2 is greater than 5.99, the null hypothesis of no proportional difference is rejected at the 5% significance level.

two had a greater proportion of the increase than expected.

Discussion. Establishment of the nursery accounted for all of the increases in cells and structures associated with the nursery and orchard land use classification. Most of this increase occurred in areas adjacent or within close proximity to the river.

Locating this operation near the river definitely benefits the nursery owners, however, it also contributes to the degradation of the river environment. The presence of this operation undermines the integrity of the Oklahoma scenic rivers program, because it could have been located in an area downstream from the designated river segment, or out of the drainage basin entirely.

Summary of Stage One

Results of this analysis depict two major trends in the change of land use within the study corridor; (1) urbanization of the rural environment by residential and commercial development, and (2) intensification of agriculture. These trends translate into an intensification of land use, a situation which adversely affects the natural character of the environment.

Intensification of land use appears to be occurring in the greatest proportions within close proximity to the river. This situation is extremely undesirable from a

river protection point of view. How these patterns of change relate to different river management objectives is the subject of the next stage of analysis.

Stage Two

Changes in the land use pattern described in stage one are related to expected outcomes of different management situations during this stage of analysis. This is done by comparing observed changes with expected changes associated with three different management situations which include: (1) management vested totally with the private sector; (2) management vested totally with the public sector through the National Wild and Scenic Rivers Program; and (3) management vested in a cooperative arrangement between private and public interests through an organization similar to the Oklahoma Scenic Rivers Commission, functioning in accordance with the Oklahoma Scenic Rivers Act. In all situations, changes from 1972-82 are compared to those from 1964-72. This is done by plotting the total number of cells and structures associated with select land uses for each inventory year. Changes from 1972-82 are compared with expected changes associated with each management situation by plotting the number of cells and structures expected in 1982 against the number observed. For the public and cooperative management situations, it is assumed that the

Illinois River was designated for protection in the early 1970's. Therefore, land use change from 1972-82 should have been constricted if either program was in effect. All situations differ with respect to the area and types of land uses under management. These differences are reflected in the procedures used to determine expected land use changes from 1972-82.

Management by the Private Sector

In this situation, expected increase in the number of cells and structures associated with select land uses from 1972-82 is hypothesized to reflect increases in the population growth of the surrounding three county region.

Methods of Comparison. To determine expected increases, the number of cells and structures present in 1972 are multiplied by the percent population increase from 1970 to 1980. These population census years do not exactly reflect the land use inventory years, though they are believed to be close enough to provide general information about growth within this region. For comparative purposes, expected increases are also figured for the 1964-72 time period. Percent population increase from 1960-70 is used as the indicator of the region's growth. Since this inventory period spanned eight years, and the population census spanned ten, the percent population increase is tailored to fit this situation by

using eighty percent of the population increase percentage.

All land uses which increased during the study period, except transportation, utilities, cropland, and pasture, are used to to determine the observed and estimated numbers of cells and structures. Since this type of management is not associated with a defined territorial jurisdiction, data from all three distance zones are included in the analysis.

The current state of land use management along the Illinois is reflected by this situation. It is hypothesized that the rate of land use intensification is related to population growth, thus in this situation the increase in the number of cells and structures associated with intensive land uses should have increased at approximately the same rate as population growth.

Population of the counties in which the study corridor lies increased by twenty-seven percent from 1960-70 and thirty percent from 1970-80. Therefore, numbers of cells and structures associated with intensive land uses should have increased by approximately twenty-two percent from 1964-72 and thirty percent from 1972-82.

Results of Comparison. A list of land uses included in this analysis along with number of cells, structures, and predicted values are provided in Tables XXI and XXII. Predicted values are plotted against observed values in

TABLE XXI

NUMBER OF CELLS WITH INTENSIVE LAND USES
OBSERVED AND EXPECTED UNDER
PRIVATE SECTOR MANAGEMENT

Land Use	1964	1972	1982
Residential	236	331	861
Other Agricultural	310	323	327
Commercial	23	48	106
Livestock Feeding	11	15	31
Nursery and Orchard	8	8	25
Institutional	20	20	21
Total Observed	608	746	1383
Total Expected	-	739	970

TABLE XXII

NUMBER OF INTENSIVE LAND USE STRUCTURES
OBSERVED AND EXPECTED UNDER
PRIVATE SECTOR MANAGEMENT

Land Use	1964	1972	1982
Residential	690	882	1359
Other Agricultural	701	769	930
Commercial	101	254	371
Livestock Feeding	23	27	60
Nursery and Orchard	8	8	44
Institutional	35	41	56
Total Observed	1526	1981	2820
Total Expected	-	1856	2575

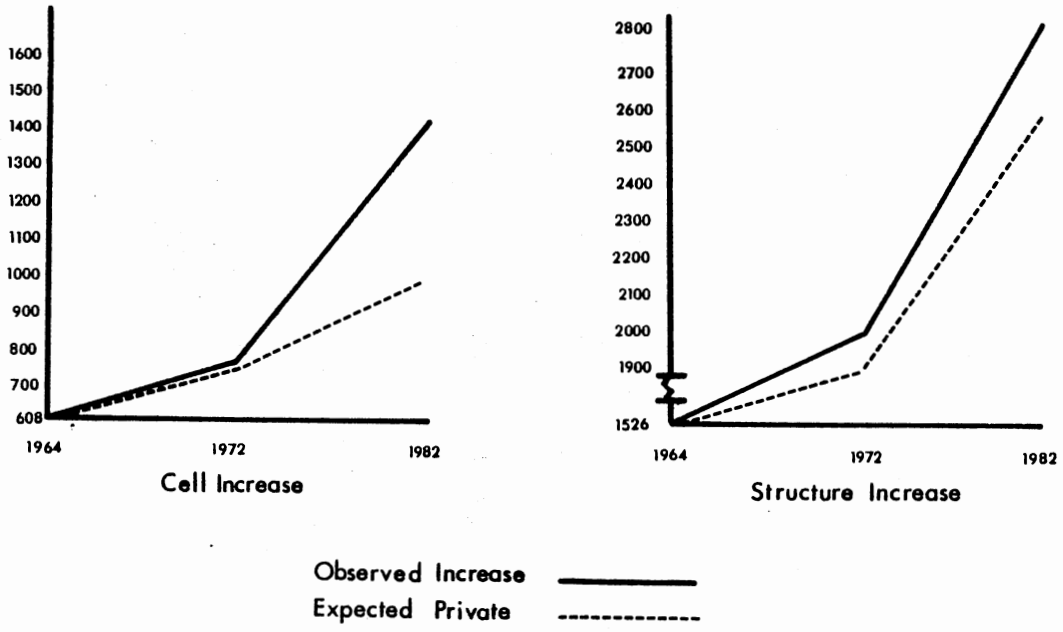


Figure 9. Expected Cell and Structure Increase Under Private Sector Management

Figure 9. Observed cell increase from 1964-72 was only slightly higher than the expected, while the observed increase from 1972-82 far out-distanced the expected values. This situation is repeated for settlement structures, as observed increases far exceeded expected increases during the latter part of the study period. These increases indicate that intensification of land use within the study corridor occurred at a rate much greater than the growth of the surrounding region.

Management by the Public Sector

It is hypothesized that the number of cells and structures associated with intensive land uses would not have increased from 1972-82 if the Illinois were managed under the Federal Wild and Scenic Rivers program.

Methods of Comparison. Only zones one and two are included in the cell and structure totals. The total area within these zones represents the territorial jurisdiction used for managing National Wild and Scenic Rivers. It is hypothesized that if the Illinois were under such management, a similar territorial jurisdiction would be utilized.

For comparative purposes, expected outcomes of private management are also plotted for 1982. Expected private outcomes are recalculated to reflect the expected situation within zones one and two.

TABLE XXIII

NUMBER OF CELLS WITH INTENSIVE LAND USES
OBSERVED AND EXPECTED UNDER
PUBLIC SECTOR MANAGEMENT

Land Use	1964	1972	1982
Residential	82	113	227
Other Agricultural	100	100	100
Commercial	14	32	79
Livestock Feeding	5	6	12
Nursery and Orchard	1	1	12
Institutional	7	7	8
Total Observed	209	259	438
Total Expected	-	-	259
Private Sector Expected	-	-	338

TABLE XXIV

NUMBER OF INTENSIVE LAND USE STRUCTURES
OBSERVED AND EXPECTED UNDER
PUBLIC SECTOR MANAGEMENT

Land Use	1964	1972	1982
Residential	239	336	536
Other Agricultural	220	244	296
Commercial	106	154	232
Institutional	21	23	30
Livestock Feeding	11	13	23
Nursery and Orchard	5	5	20
Total Observed	602	775	1137
Total Expected	-	-	775
Private Sector Expected	-	-	1007

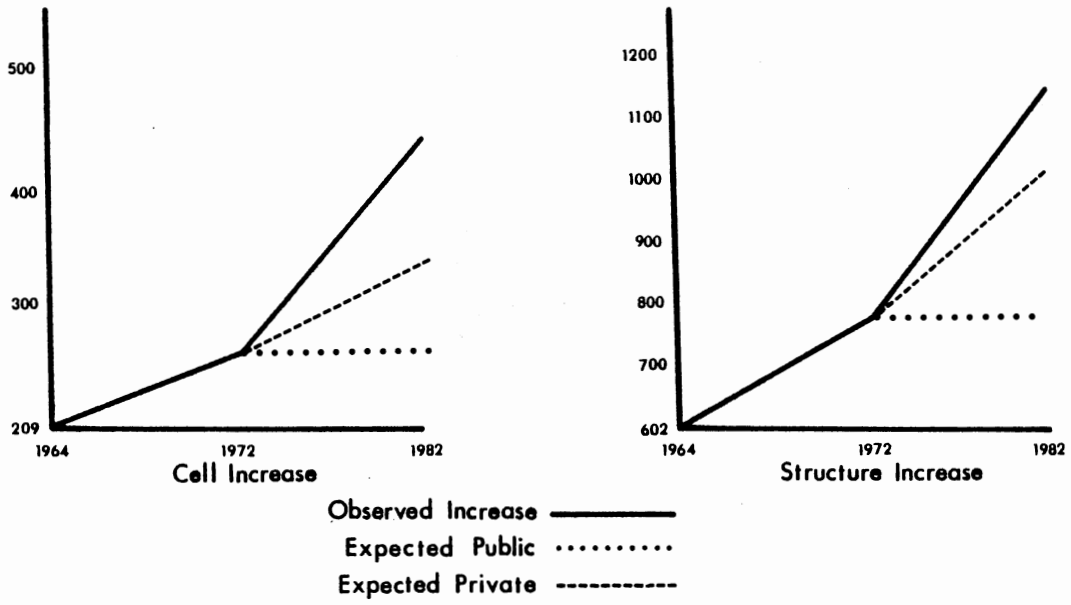


Figure 10. Expected Cell and Structure Increase Under Public Sector Management

Results of Comparisons. Expected outcomes of this type of management are compared to the actual land use increase from 1972-82. Tables XXIII and XXIV lists the land uses, number of cells, structures, and expected values for each inventory year. Expected values for outcomes of private sector management are also included for comparative purposes.

Expected values are plotted against observed values, which indicates the differences between expected and observed increase in cells and structures from 1972-82. The observed cell increase far exceeded the expected increase associated with public sector management (Figure 10). This increase is repeated for the number of structures. Such increases are not unexpected because the results of stage one indicated the greatest proportional intensification of land use occurred within zones one and two. Cell and structure increases in these zones also increased at a rate greater than the growth of the surrounding region. Another difference between the observed land use change and the expected patterns of land use associated with public management is the lack of increase in other built-up lands. If the river environment were under such management, then the number of public river access and other public open spaces would be expected to increase. Thus, cells and structures associated with the other built-up category would have been expected to increase.

Management Through a Cooperative Arrangement

If the Illinois were managed under this situation, it is hypothesized that increases in cells and structures associated with intensive land uses would have been constricted from 1972-82. Because the Oklahoma Scenic Rivers Act exempts traditional agricultural practices from management, cells and structures related to other agricultural land uses, e.g. farmsteads and barns, are excluded from the totals (Oklahoma House of Representatives, 1970).

Methods of Comparison. Only cells located within zones one and two are included in this analysis. This zone approximates the area which would be under the jurisdiction of the Oklahoma Scenic Rivers Commission. For comparative purposes, expected outcomes from private and public sector management are also determined and plotted for zone one.

Results of Comparisons. If this situation was imposed in the early 1970's, it is hypothesized that increases in the number of cells and structures associated with intensive land uses would have been constricted. A list of uses and the numbers of observed and expected cells and structures are given in Tables XXV and XXVI. Expected values are plotted against observed values, which

TABLE XXV

NUMBER OF CELLS WITH INTENSIVE LAND USES
OBSERVED AND EXPECTED UNDER
COOPERATIVE MANAGEMENT

Land Use	1964	1972	1982
Residential	52	69	221
Commercial	7	20	79
Institutional	4	4	4
Livestock Feeding	1	2	3
Nursery and Orchard	0	0	1
Other Agricultural*	35	38	38
Total Observed	99	133	346
Total Expected	-	133	133
Private Sector Expected	-	-	172
Public Sector Expected	-	-	133

*Excluded from cooperative management expected total.

TABLE XXVI

NUMBER OF INTENSIVE LAND USE STRUCTURES
OBSERVED AND EXPECTED UNDER
COOPERATIVE MANAGEMENT

Land Use	1964	1972	1982
Residential	141	202	312
Commercial	58	92	138
Institutional	14	16	18
Livestock Feeding	5	6	7
Nuseries and Orchards	0	0	0
Other Agricultural*	73	87	105
Total Observed	291	413	580
Total Expected	-	413	431
Private Sector Expected	-	-	537
Public Sector Expected	-	-	413

*Excluded from cooperative management expected total.

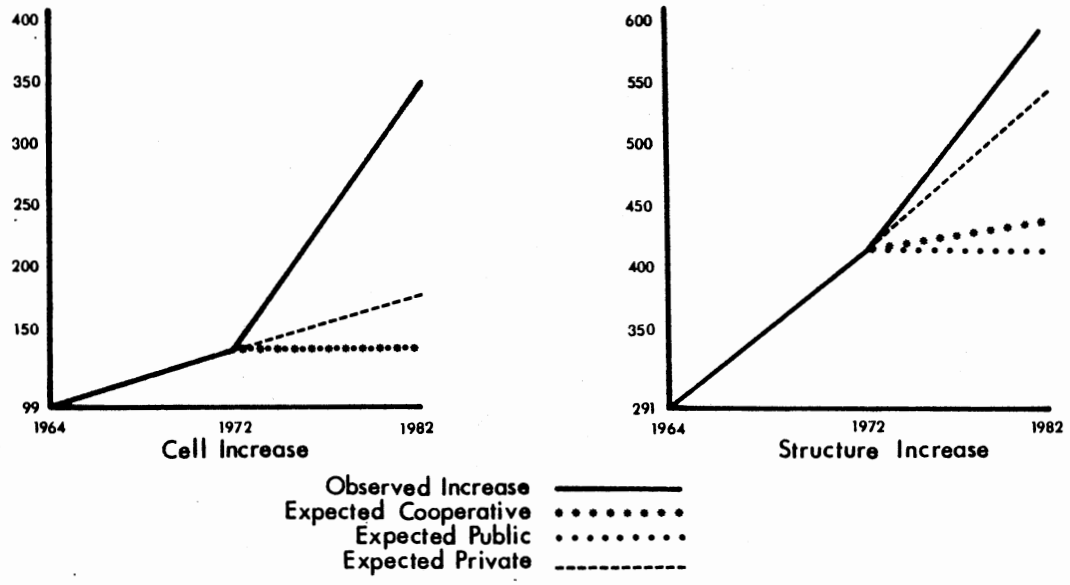


Figure 11. Expected Cell and Structure Increase Under Cooperative Management

shows differences between expected and observed increases in cells and structures from 1972-82. These figures indicate that the increase of cells and structures (Figure 11) was much greater than would be expected if a cooperative management mechanism were functioning in a manner consistent with the Oklahoma Scenic Rivers Act. In fact, actual increases of both structures and cells within the probable territorial jurisdiction of such management was much greater than the growth rate of the surrounding region. Again, this situation is consistent with the patterns of land use change illustrated in stage one of this analysis.

Summary of Stage Two

Results of these analyses indicate that the intensification of land use from 1972-82 most closely reflects the management objectives of a private sector management situation. During this period, land use intensified along the Illinois at a rate much greater than the growth of the surrounding region.

This situation is probably tied to the environmental amenities of the area, which makes it attractive to commercial, recreational, and residential development. Similar amenities likely encouraged the development of the livestock feeding and nursery operations which located in the river corridor.

Another possibility worth consideration is the role the legislature played in development through designating the river as a "State Scenic River", without specifying an effective managing mechanism. This action undoubtedly focused attention on the river, making it an even more attractive investment for commercial recreation entrepreneurs and residential developers, while the lack of a defined management mechanism allowed the development to occur.

CHAPTER V

SUMMARY AND CONCLUSIONS

Summary

This research indicates that land use along Oklahoma's section of the Illinois River intensified from 1972-82 at a rate substantially greater than that which occurred from 1964-72. Intensification during this period also occurred at a rate greater than the growth of the surrounding region. Commercial and residential land uses were the major contributors to the increase in development. Consequently traditional patterns of land use within the Illnois Valley have been altered. These developments, along with the intensification of agriculture, have modified the natural character of the river environment. Therefore, the lands adjacent to the Illinois River are not being managed in a manner consistent with the environmental protection objectives specified in the Oklahoma Scenic Rivers Act.

It could be concluded that the Oklahoma river protection program has been a failure in the Illinois River case. However, such a statement would not contribute

to the understanding of the changing land use situation along the Illinois River. When we speak of land use change, we are referring to changing patterns, and, for patterns to change, some type of process or processes must be present to instigate these changes.

Throughout this thesis, various cultural processes affecting river use have been identified. In the following sections, these processes, and their relation with the Illinois River situation, are discussed.

Processes Influencing Land Use Along the Illinois River

Increased Popularity of River Recreation. This thesis has made reference to a dramatic increase in river recreation. This increase is attributed to changes in society's perceptions of rivers, redefinition of rivers as environmental and recreational resources, and improvements in river running technology. Accompanying this popularity has been increased commercial and residential development along river corridors, as business entrepreneurs seek profits from the recreating public. At the same time potential home owners seek dwelling sites along their newly found playgrounds. These trends are common to many river environments and are occurring along the Illinois River.

Residential Development In Rural Areas. Residential development is a process occurring in many rural areas possessing environmental and recreational amenities. In such situations, rivers are regarded as foci attracting residential development. Such processes along the Illinois River are signified by the number of dwellings along the river, as well as the presence of the two rural residential subdivisions.

Intensification of Agriculture. This type of agricultural process is occurring throughout the world as agriculturalists strive to feed our expanding population. In this thesis, reference is also made to the effects rural residential and commercial development have on the intensification of agriculture. Within the Illinois Valley, this process is represented by numerous livestock feeding operations and the presence of a nursery.

The factor underlying all of these processes is population growth. Population growth has, and will continue to put unprecedented demands on the Earth's resources, including rivers(Craighead, 1965). In light of increasing demands, the question facing river management is not how to best use rivers, but rather, how to allocate use among users. The Illinois River, and its surrounding environment, was officially designated as a protected recreational resource by the Oklahoma Legislature, but, the processes previously mentioned have successfully

challenged this resource allocation, as the land use pattern along the Illinois River has been altered by these processes. Since these processes are common to many river environments successfully allocated for protection, characteristics unique to the Illinois River situation may have hastened this action.

Characteristics Unique to the Illinois River Situation

Regional Uniqueness of the Illinois River. As previously mentioned, the Illinois River is a unique resource in a state possessing few river resources suitable for recreation use. This uniqueness is most likely a factor contributing to increased recreation use, along with commercial and residential development. Smith (1977) summarizes this situation:

> The Illinois River is a major summer playground, Oklahoma's only family recreational river, the first such river that folk from the water shy Great Plains encounter when they travel east (p. 31).

Location of the Designated River Segment in Relation to the Arkansas Poultry Producing Region. Oklahoma's section of the Illinois River is directly adjacent to northwest Arkansas, one of the nation's major poultry producing regions (Smith, 1977). Most of the livestock

feeding operations which have entered Oklahoma's Illinois Valley are related to the major poultry producers of northwest Arkansas. Therefore, the increase in animal feeding operations along Oklahoma's section of the Illinois River probably results from the expansion of these operations.

Accessibility. The Illinois River Valley is highly accessible due to the presence of several paved and non-paved roads. It is likely that this accessibility influenced and supported development within the river valley.

Economic Status of the Three County Region. The protected segment of the Illinois River flows through an economically depressed, three county region of Oklahoma. Therefore, it is logical that land owners and public officals welcome, and encourage, development along the Illinois. After all, development is associated with creation of jobs, increased land values, and increased revenue for local economies.

It is likely that all of these characteristics sped up the change in land use patterns along the Illinois River. Because the changing patterns of land use are the effects of processes, hastened by factors unique to the Illinois River situation, the failure of Oklahoma's river protection program to achieve the Scenic Rivers Act's

environmental objectives is probably the result of not confronting these processes in the context of the Illinois River situation. How Oklahoma's river protection program failed to address these processes is related to the program's development, which is discussed in the next section.

Problems Related to Oklahoma's River Protection Program

In Chapter I, the importance of adopting a management mechanism simultaneously with designating river environments for protection was stressed. In the Illinois River case, designation occurred in 1970 in conjunction with the passing of the Oklahoma Scenic Rivers Act. However, the management mechanism was not adopted until the act was amended in 1977. During the ensuing time span, the processes instigating land use change along the Illinois River commenced unchallenged, because no managing mechanism was in force. Undoubtedly, the designation of the Illinois as a State Scenic River also contributed to land use change, because attention was focused on the river's environmental and recreational amenities.

By the mid 1970's, land use change had attracted the attention of those concerned with the future of the Illinois as a protected recreational river resource. This attention eventually resulted in the creation and adoption

of a cooperative management mechanism, augmented with state support. Throughout the literature, such mechanisms are regarded as viable management options for rivers flowing largely through private lands. It is also pointed out, however, that cooperative management mechanisms can be manipulated to serve local resource development interests. If such a situation arises, then the environmental protection objectives can be jeapordized, and, the management mechanism must then be changed. In the Illinois River case, the management mechanism has not confronted the processes leading to the changing patterns of land use within the valley. Thus, the processes which commenced prior to the adoption of the management mechanism have been perpetuated, and, the associated changes in land use have been allowed to continue. Failure of the current managing mechanism to confront these processes is understandable, since the managing body consists primarily of local interests, who likely view the economic growth associated with these processes as a desireable management outcome.

Finally, the literature indicates that a strong, visible constituency is a necessary element of any state river protection program. Lack of a visible constituency in the Illinois River case has not been a major problem, as passage of the Scenic Rivers Act and amendments creating a management mechanism could not have

materialized without such support. However, this supporting constituency has not been strong enough, politically or monetarily, to offset those advocating development of the river environment, evident by the unchallenged continuance of land use change along the Illinois. Until these circumstances change, it is unlikely that any change in the management of the Illinois River and environment will occur.

Future Management Possibilities

The current management mechanism adopted to attain the environmental protection objectives of the Oklahoma Scenic Rivers Act has been unsuccessful in the Illinois River case. Therefore, some type of management change is necessary if these objectives are to be achieved.

Strong management controls, such as those associated with the Federal Wild and Scenic Rivers Program, are unlikely to be adopted as they would incur high costs of land acquisition, and, encounter strong political opposition. If any change occurs, it will likely involve the restructuring of the present cooperative management mechanism. In order to be effective, the restructured mechanism must involve more representation from interests not tied to local resource development objectives. It is important to distinguish between those with vested interests in local resource development from those without

because the former will most likely seek to maintain the status quo than the latter. This difference is also more important than the distinction between local and non-local interests, since not all local interests are tied to resource development objectives, while some non-local interests inevitably are. The latter situation is illustrated by the number of residential, commercial, and agricultural developments supported by non-local interests.

Conclusions

Oklahoma's river protection program has not achieved the environmental protection objectives specified in the Oklahoma Scenic Rivers Act. This situation stems from the program's failure to confront several cultural processes, produced by characteristics unique to the Illinois River situation, which resulted in changes in the land use pattern along the river.

The Oklahoma river protection program illustrates three problems associated with river, and environmental protection programs. First, if an area is designated for protection without specifying a management mechanism, then resource protection becomes difficult, if not impossible. Secondly, if management is vested in a cooperative mechanism, then management runs the risk of being manipulated to achieve local objectives, rather than the

designated environmental protection objectives. Finally, the lack of a strong, visible constituency, supporting environmental protection objectives, can led to the creation and perpetuation of weak management mechanisms.

The changing land use patterns along the Illinois River can be viewed as a lesson illustrating the shortcomings of a state's attempt to organize a river protection program. Though these findings are related specifically to the Illinois River case, it is believed that the shortcomings of Oklahoma's river protection program are problems common to many river protection programs. Perhaps with sound judgement and planning these problems can be avoided in the restructuring of Oklahoma's river protection program or in the creation of other river protection programs.

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