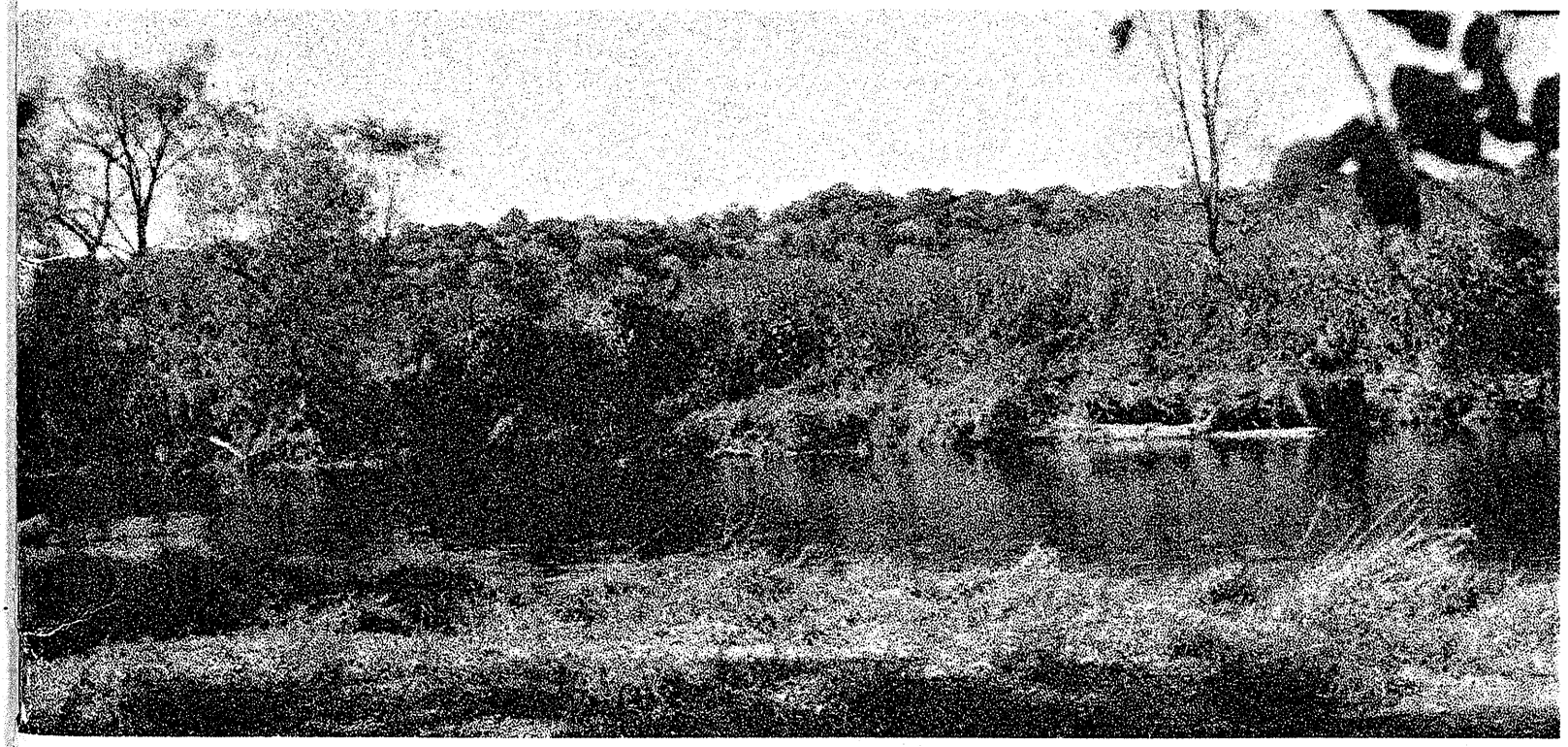
Boone River Protected Water Area Management Plan



Prepared by the Iowa Conservation Commission
August 1985

IOWA
CONSERVATION COMMISSION

PREFACE

The Iowa Conservation Commission on May 2, 1985, designated a twenty-five mile segment of the Boone River in Hamilton County into Iowa's Protected Water Areas (PWA) system. The designation is in accordance with Chapter 108A, Code of Iowa, enacted in 1984.

This plan was prepared to guide the project's implementation, which includes establishing and monitoring protection agreements with landowners, maintaining the numerous resources that make the river a worthy PWA, and managing recreational use. The Boone River is Iowa's first PWA. It will serve as a model project for future designations as we make important strides in protecting those lakeshores, river corridors, and marshes in Iowa that possess outstanding natural, cultural, and scenic resources.

TABLE OF CONTENTS

SUMMARY

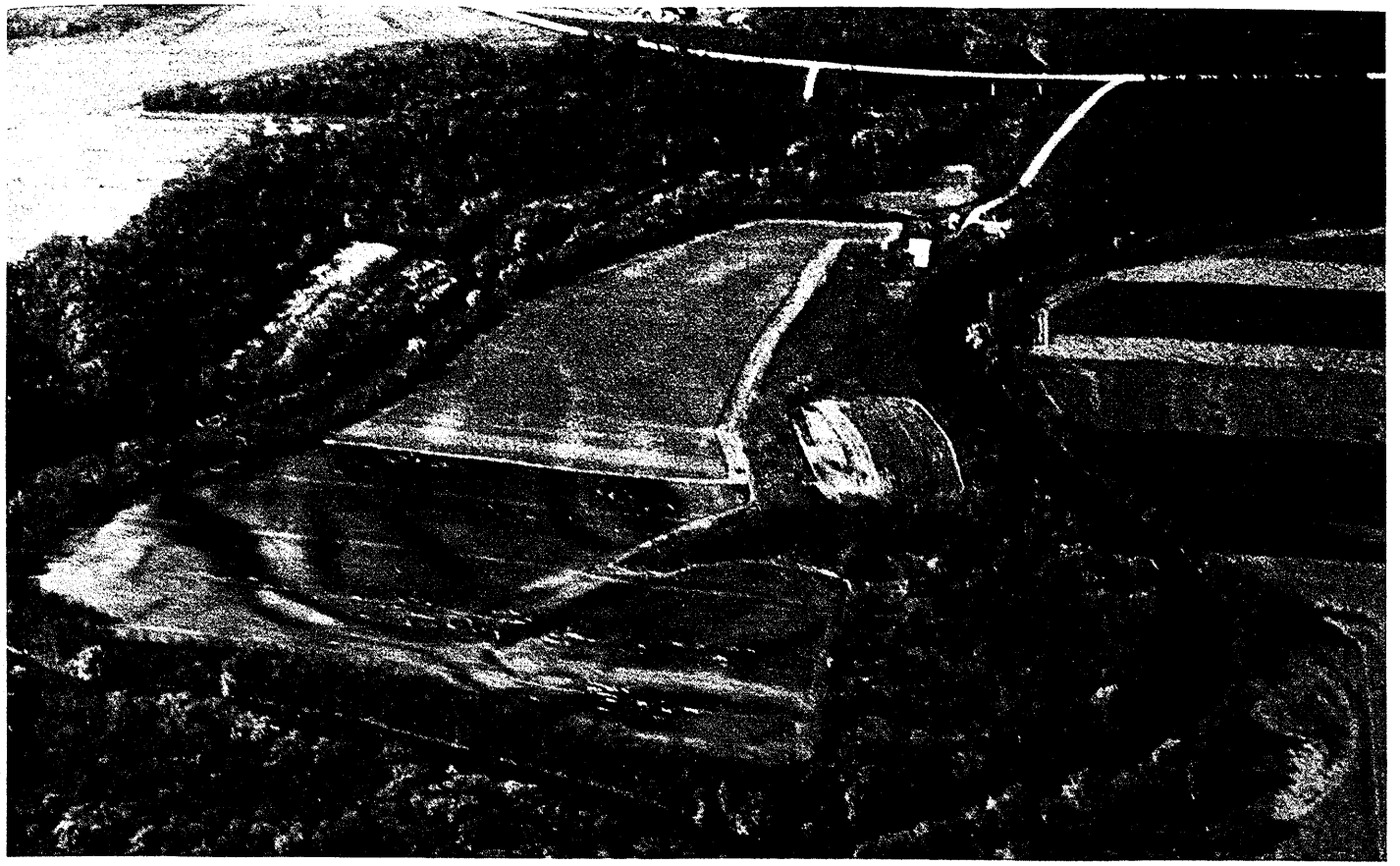
The Boone River in Hamilton County from Webster City to the Des Moines River possesses many outstanding natural and cultural resources. It is truly one of Iowa's most scenic, free-flowing rivers. The Iowa Conservation Commission recognizes these qualities and has designated this segment of the Boone River into the state's Protected Water Areas (PWA) system under the authorities granted in Chapter 108A, Code of Iowa. The designated area includes 25 miles of river and 6,338 acres of land, of which 5,180 acres are in private ownership and 1,158 acres are publicly owned.

The Boone River valley is part of central Iowa's largest expanse of woodland. Many species of game and nongame wildlife are abundant in the river and its valley. The river's water quality is excellent and supports a very good fishery. Woodland voles, showy lady's-slipper orchids, and eastern mound-building ants are rare or endangered in Iowa and are known to exist in the Boone River PWA. The valley is rich in historical and prehistorical resources, including several mill sites and Indian settlements.

The basic management principle for the Boone River PWA is that several different land and water uses can coexist along the river. The key will be to locate and manage these uses in a manner which will have minimal impact on one another, and on the natural, cultural, and scenic resources. ICC biologists are available to assist landowners in developing forest, wildlife, and fisheries management plans. An ICC seasonal staff position is proposed to conduct a public relations program for river recreationists and landowners during summer months.

The PWA program is designed to maintain and enhance existing resources through long-term, customized agreements with willing landowners. Available agreements include conservation easements, leases, state preserve dedications, property tax incentives, and land acquisitions. The selected agreement will not necessarily allow public access onto private property. Fifty-four (54) of the 91 landowners in the designated area support the program and 43 landowners are willing to negotiate some type of PWA agreement.

The average cost of PWA agreements is estimated at $220 per acre. Total cost of river protection, assuming all landowners will someday be willing to participate, will be approximately $1.22 million, or $122,000 per year over a ten-year negotiation period. Another cost associated with PWA designation is conversion of the river access at Bever's Bridge from private to public ownership. The estimated price for land acquisition and parking lot construction is $5,000 to $7,000. The primary PWA funding source will need to be the state of Iowa's General Fund. Supplemental funds may be available through existing conservation and recreation programs, and through some federal and state cost-sharing programs.



CHAPTER ONE
INTRODUCTION

Meet the Boone River

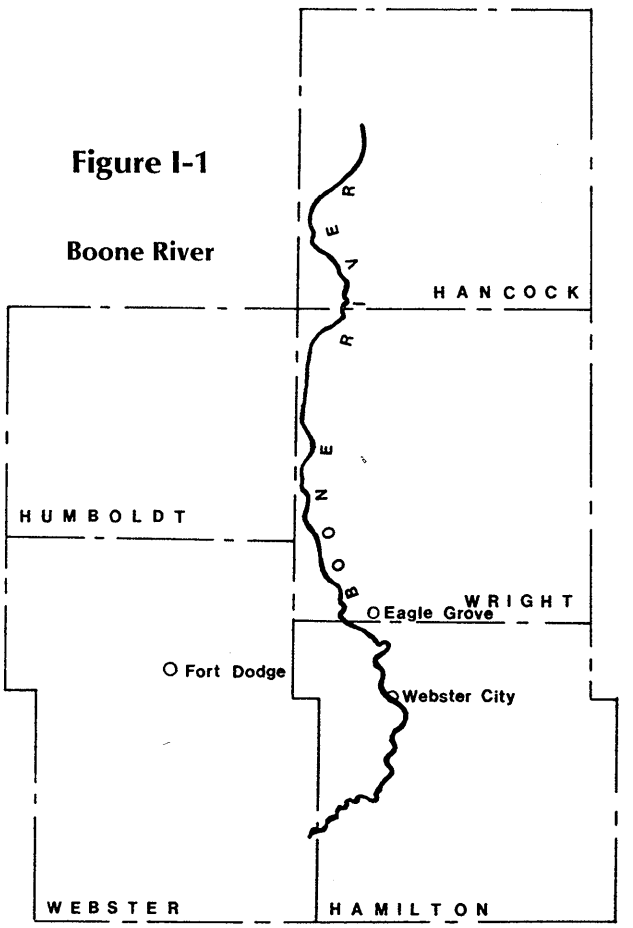
The Boone River and its valley are special. The portion between Webster City and its mouth at the Des Moines River is one of Iowa's most scenic, natural river reaches. It is special to those people living along it and to those who visit it. Many people may never see, hear, or feel the Boone River, but are comforted by just knowing a place like it still exists in the state.

The Boone River originates in Hancock County and meanders about 85 miles before joining the Des Moines River in Webster County (see Figure I-1). It drops an average of 4.3 feet per mile, drains some 906 square miles of central Iowa, and empties 399 cubic feet of water per second into the Des Moines River during normal flows. The river's water quality is good and among the best in the region. Major tributaries of the Boone River include Prairie, Brewer's, Otter, Eagle, and White Fox Creeks.

The upper three-quarters of the river (from its source to Webster City) has a relatively unrecognizable, low relief valley that is primarily developed for agricultural purposes. The valley of the lower river reach (between Webster City and the Des Moines River) is much more distinct with steep, wooded hillsides defining its margins. No dams are located on this lower reach to disrupt the river's free-flowing character. These general characteristics provide for a variety of plants and animals, as well as many outdoor recreation opportunities. The valley also contains numerous sites of historic interest. All these factors combine to make this lower reach of the Boone River a very worthy component of Iowa's Protected Water Areas program.

Figure I-1

Boone River



Meet the Protected Water Areas (PWA) Program

The PWA program was initiated in 1978 with the preparation of a statewide general plan to guide its development and implementation. The plan was completed in early 1981, approved by the Iowa Conservation Commission, and submitted to the state legislature. The legislature enacted the PWA law in 1984 (see Appendix A). The general plan and legislation were designed to replace the Scenic Rivers Act of 1970 with a more definitive and operational program.

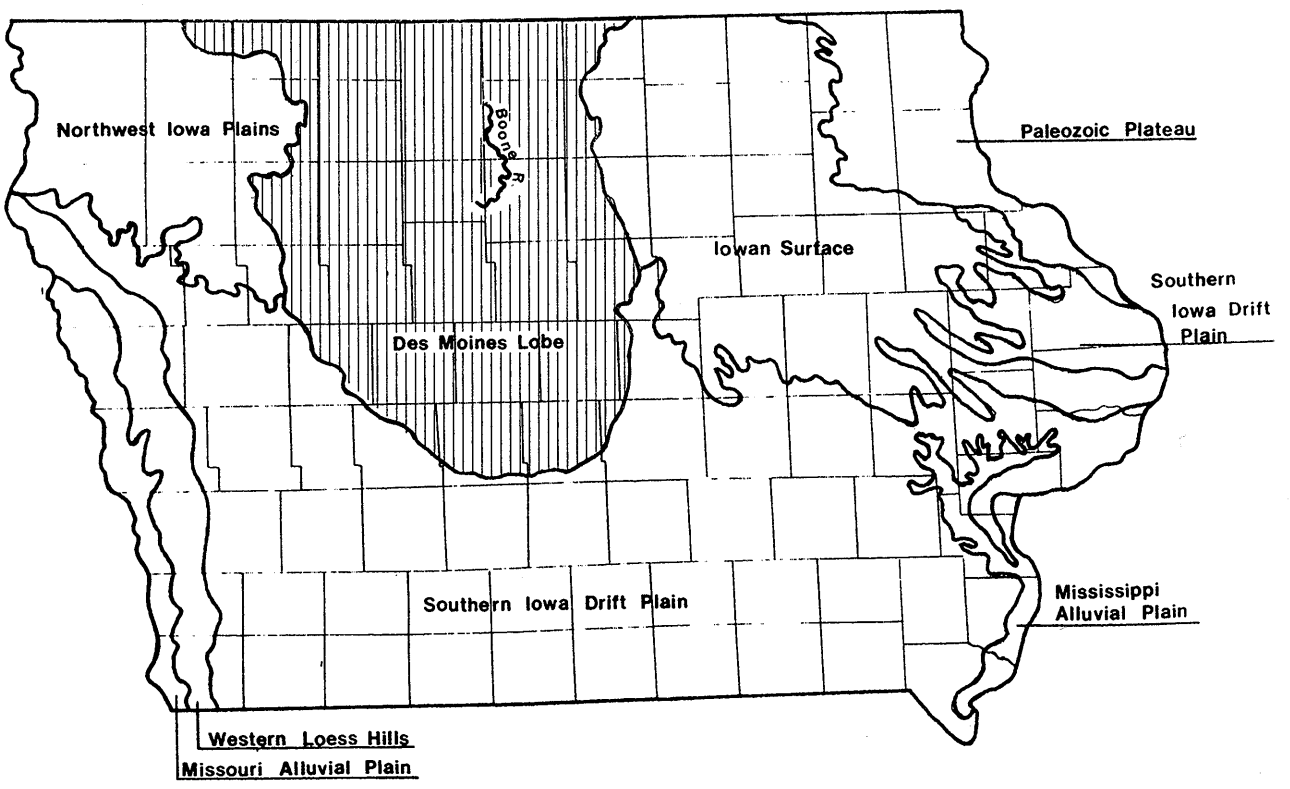
The basic purpose of the PWA program is to maintain existing natural and scenic qualities of selected lakes, rivers, and marshes and their adjacent land areas. Areas designated into the program will be jointly managed by the people and agencies owning land along the lake, river, or marsh. The ICC will provide leadership and coordination for those property owners who are interested in assuring that their land next to the water resource will look much the same in the future as it does today. This coordinated management will be accomplished through agreements between the landowners and ICC. These agreements can be in the form of conservation easements, leases, property tax breaks, state preserve dedications, or land acquisitions from willing sellers by the ICC. The actual method or methods used will depend upon landowners' individual interests and personal situation, and upon the specific resources identified for protection.

Most of today's property owners along lakes, rivers, and marshes that qualify for the PWA program are taking good care of their land. However, economic pressures statewide are inducing many landowners to pursue more intensive land uses, generally at the expense of natural and cultural resources. Land also changes hands frequently over time, and new owners may not be as conscientious about resource management as the previous owners. The PWA program can help assure that future landowners will possess the same sets of values as those of current and past owners; thereby assuring designated areas will remain the outstanding natural resources they are today.

The long-range goal of the PWA program is to designate and protect at least one example of a natural water area in each of Iowa's seven landform regions. This accomplishment will assure natural water areas throughout the state are represented in the program. The Boone River is in the Des Moines Lobe landform region covering north-central Iowa (see Figure I-2).

Figure I-2

Iowa's Landform Regions



and Objectives of Boone River PWA Designation

oal of Boone River PWA designation is to maintain nhance the valley's natural and cultural resources ture years. Resources of primary interest include soil, vegetation, fish, wildlife, geological, historical, haeological.

c objectives of Boone River PWA designation are

tect the existing natural and pastoral character of ley's landscape from incompatible uses.

mote public health, safety, and general welfare by ng aesthetic and environmental damage to the River's outstanding water and associated land s that might otherwise result from incompatible ment patterns.

ct and enhance water area environments in a which ensures continued fish and wildlife on.

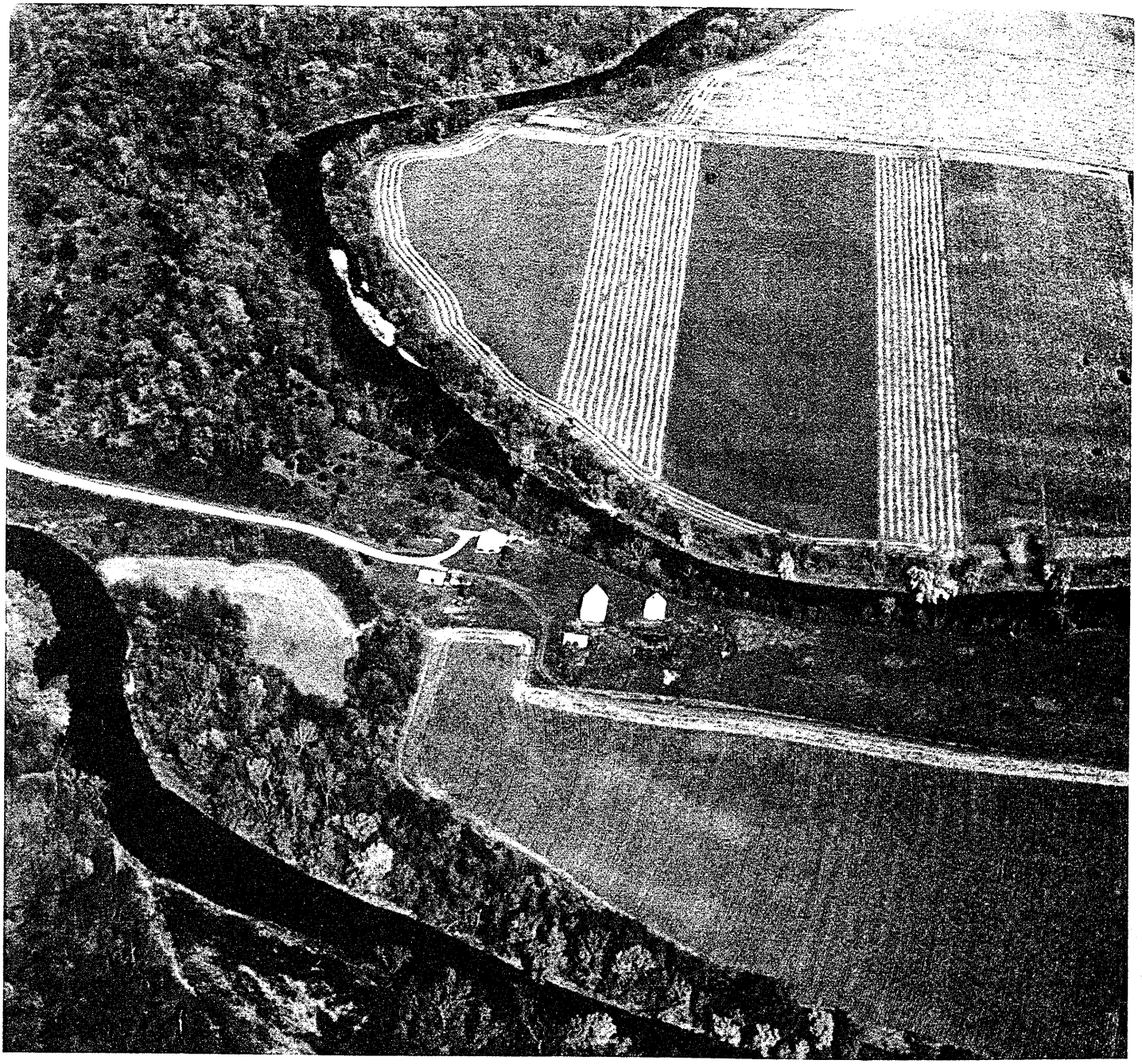
4. Maintain or improve water quality in the Boone River that is consistent with its established and potential uses.

5. Preserve natural, cultural, and scenic features which enhance recreational and educational experiences within the valley.

6. Maintain the natural, free-flowing character of the river.

7. Develop and implement recreational use guidelines aimed at gearing human use of the Boone River in a manner to ensure: (a) resource protection; (b) observance of private landowners' rights; and (c) enhancement of quality recreational experiences.

8. Coordinate Boone River management with associated programs of other local, state, and federal agencies and private organizations in a manner that will provide comprehensive, complementary protection of the valley.



CHAPTER TWO
BOONE RIVER STUDY AREA

Study Area Identification

The Iowa Protected Water Area General Plan (ICC, 1981) identified a proposed Boone River study area in general terms from Webster City to the Des Moines River. The river segment is defined more specifically in this management plan as beginning in Webster City at the confluence of Brewers Creek and ending at the confluence with the Des Moines River. This includes 25 miles of river.

Topography was the initial criterion used in determining the study area width. Land ownership boundaries were transferred from Hamilton County Assessor's plat books to a USGS topographical map. Since watershed protection is one goal of the PWA designation, landowners were included whose property was not immediately along the river but which contained significant tributary streams. If there was any doubt whether to include an area or not, it was included in the initial study area. One hundred and eleven (111) private landowners were in the original study area.

When the ownership boundaries were transferred to an aerial map, nine (9) landowners were dropped because the intermittent streams running through their property were relatively treeless. After a preliminary resource inventory and initial landowner contact, eleven (11) more properties were dropped primarily because the wooded portion of their property was not adjacent to the river and was not contiguous with riparian woodland. In addition, these woodlands were usually very small or heavily grazed, scattered and open. Figure II-1 shows the final study area.

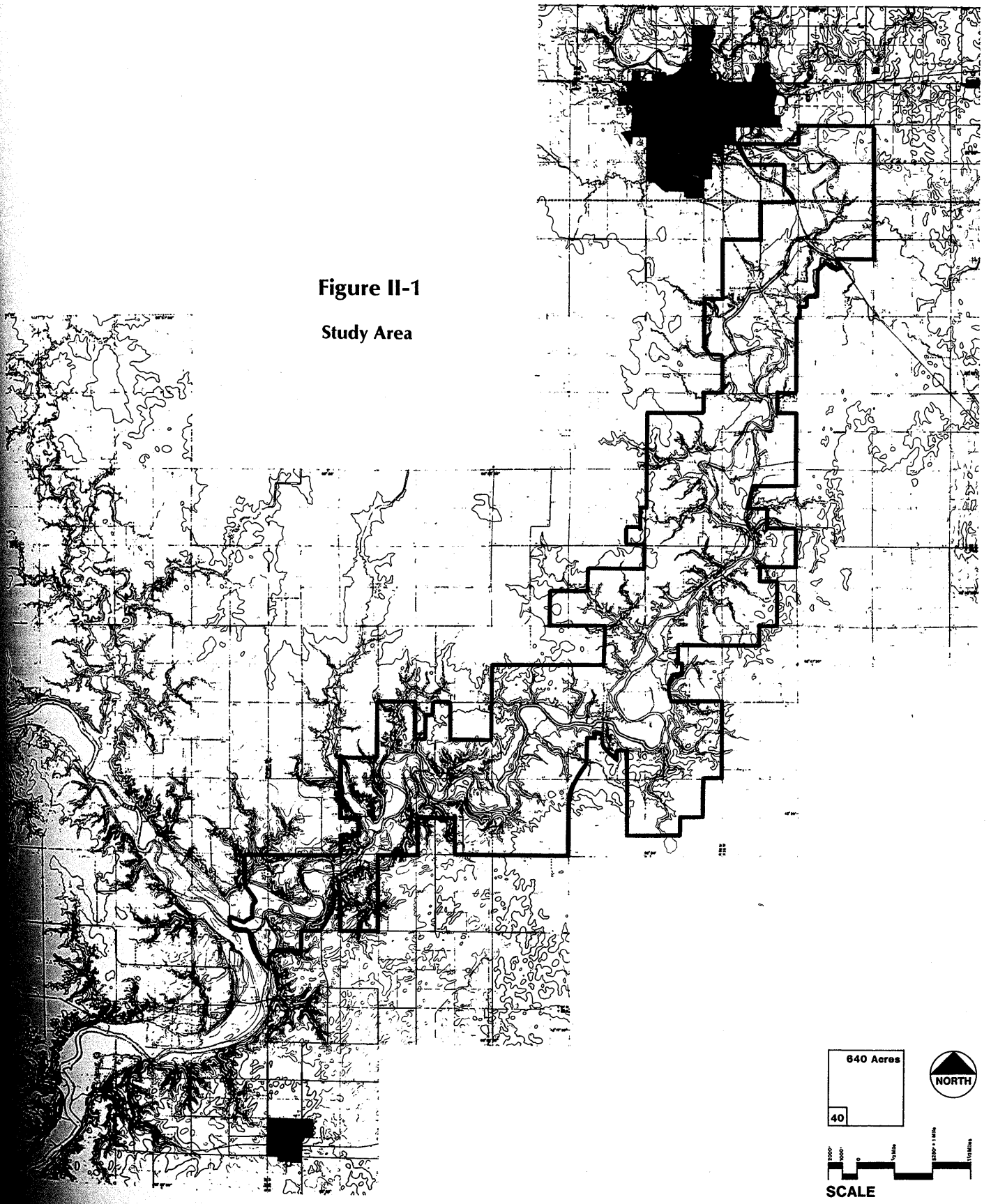


Figure II-1

Study Area

Land Use

The Boone River was one of the first areas settled in Hamilton County. The timber provided building materials, fuel, shelter from the harsh winter winds, and shade from the prairie sun. The river provided a water supply, a transportation mode, power, and habitat that produced abundant wildlife for trapping, hunting, and fishing. The valley was developed over the years to better provide for the area's increasing uses and users. The following sections describe the land uses of the present day Boone River valley.

Agricultural Use — Agriculture is the principal land use in the area. Cash crops such as corn and soybeans, and beef and pork production are the major income sources. Other land uses include pastureland, vegetable gardens, orchards, Christmas tree farms, mink production operations, and public recreation areas.

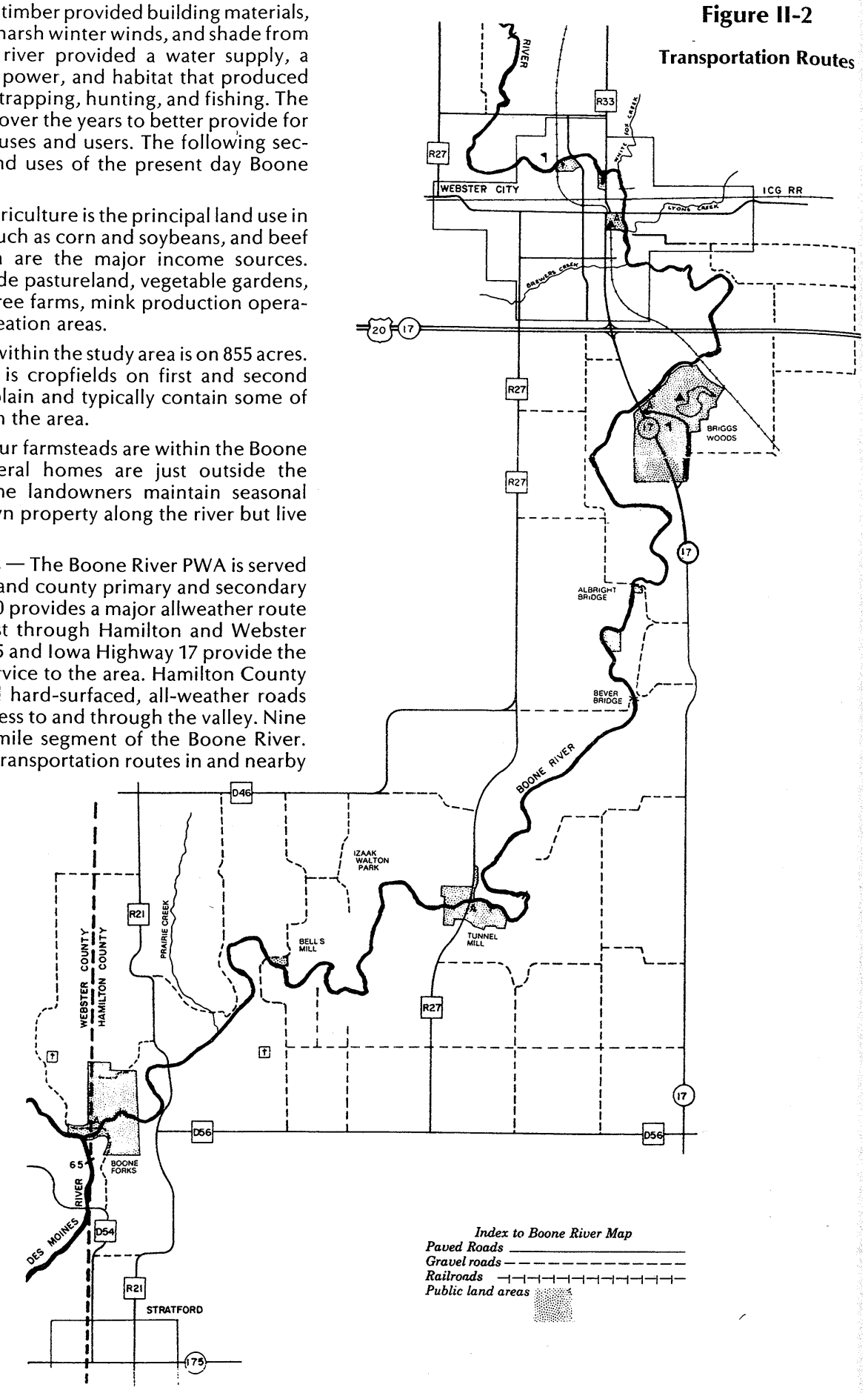
Agricultural land use within the study area is on 855 acres. Most of this acreage is cropfields on first and second terraces of the floodplain and typically contain some of the most fertile soils in the area.

Residences — Only four farmsteads are within the Boone River PWA, but several homes are just outside the designated area. Some landowners maintain seasonal homes, and others own property along the river but live elsewhere.

Transportation Routes — The Boone River PWA is served by a network of state and county primary and secondary roads. U.S. Highway 20 provides a major allweather route running east and west through Hamilton and Webster Counties. Interstate 35 and Iowa Highway 17 provide the major north/south service to the area. Hamilton County also maintains several hard-surfaced, all-weather roads that provide good access to and through the valley. Nine bridges cross the 25-mile segment of the Boone River. Figure II-2 delineates transportation routes in and nearby the designated PWA.

Figure II-2

Transportation Routes



Industry — No commercial or industrial operations are currently within the Boone River PWA. This fact is a good example of the river's overall natural character.

Recreation — A variety of recreational opportunities exist along the Boone River. These include: hunting, trapping, fishing, golfing, canoeing, camping, picnicking, hiking, snowmobiling, birding, photography, and nature studying.

The Hamilton County Conservation Board (CCB) manages five public recreation areas along the Boone River (ICC, 1983). Briggs Woods Park is the largest, 497 acres with an 80-acre lake, and provides the most diverse recreation facilities, including a modern campground, picnic areas, swimming beach, fishing, boating, baseball fields, shooting range, golf course, hiking trails, hunting area, and outdoor classroom activities coordinated by a full-time naturalist.

Bells Mill Park, although only 8 acres, is a heavily used camping and picnicking area. It is also a popular river access for canoeists.

Tunnel Mill consists of 235 acres and is owned by the Iowa Conservation Commission and managed by the Hamilton CCB. Recreation facility development is limited, but the area offers hunting, trapping, fishing, primitive camping, picnicking, hiking, and canoeing opportunities.

Richard Barnes Wildlife Area is a relatively undeveloped 29-acre area. Hunting, trapping, and primitive camping are the main activities it provides to outdoor enthusiasts.

Albrights River Access is 10 acres and also offers hunting, primitive camping, fishing, and canoeing opportunities.

All the above mentioned areas, except Richard Barnes Wildlife Area, have public river accesses for small fishing boats and canoes. Three private accesses are also commonly used by the public with permission by landowners. They provide a number of canoe trips differing in distance and travel time. A total of eight accesses are on the 25 miles of river and are listed in Table II-1 and shown in Figure II-2 (Knoll, 1982).

Table II-1
Boone River Accesses

	Location (miles from river's mouth)	Ownership
[illegible] Street Access	24.40	Private
[illegible] Woods	21.45	Public
[illegible] Bridge	18.00	Public
[illegible] Bridge	15.75	Private
[illegible] Mill	10.35	Public
[illegible] Park	5.35	Public
[illegible] Bridge	2.45	Private
[illegible] Bridge		
[illegible] Forks WMA)	.30	Public

[illegible] Bridge Access is in private ownership, but it is [illegible] by the Hamilton CCB through a cooperative [illegible] with the landowner.

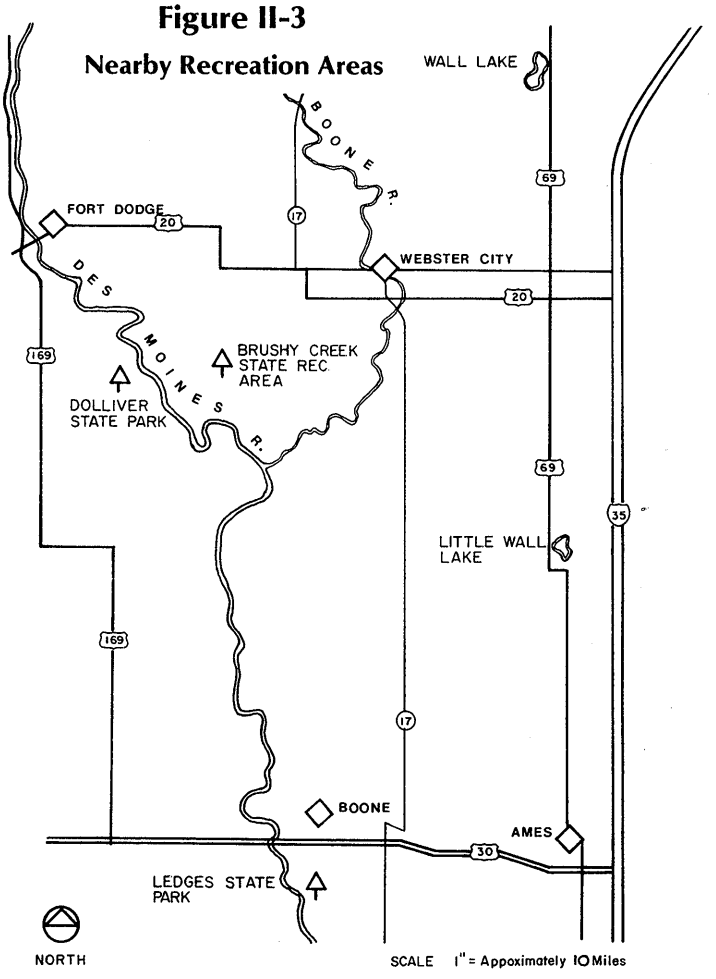
[illegible] Iowa Conservation Commission owns and manages [illegible] Boone Forks Wildlife Management Area (WMA). It is [illegible] acres of public land used primarily for hunting, [illegible]pping, wildlife observing, primitive camping, and hiking. This area is a small part of a large scale ongoing project by the Iowa Conservation Commission (ICC, 1980). The proposed acquisition from willing sellers of 14,000 acres along the Des Moines and Boone Rivers would connect three existing state wildlife management/recreation areas (Boone Forks, Tunnel Mill, and Brushy Creek) into one contiguous unit. The purposes of this project are to (1) increase public recreation opportunities in central Iowa; 2) provide quality habitat for numerous wildlife species, and 3) protect the largest remaining expanse of woodland in central Iowa. Maximization of wildlife production is the key objective to management efforts. Expanded travel lanes, creation of food patches, undisturbed nesting cover, and brood rearing habitat for both game and nongame populations are management goals. Ten river miles of the Boone River PWA are within the Boone Forks Wildlife Management Area. Both programs share a common goal of resource protection and conservation.

Other major recreation areas in the vicinity include Dolliver State Park, Brushy Creek Recreation Area, and Little Wall Lake Park (see Figure II-3). These areas offer a variety of day-use and overnight facilities.

Water Use

Boone River water is used for many purposes to include: recreation, irrigation, a waste dispersal medium, and indirectly as a domestic water source. Many fish and wildlife species and numerous aquatic life forms are tied directly to water resources for physical subsistence.

Figure II-3

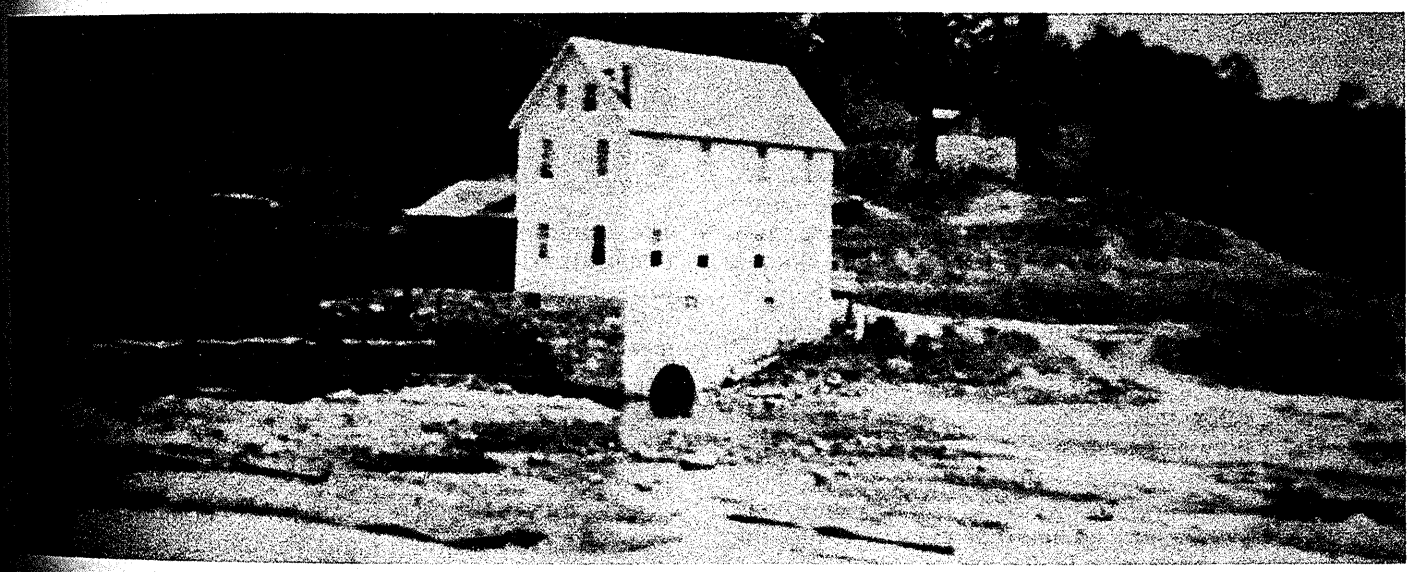


The Boone River provides a range of recreational activities such as canoeing, swimming, innertubing, wading, fishing, waterfowl hunting, furbearer trapping, snowmobiling, skating, and sledding. Some recreationists simply enjoy the scenery, outdoor sounds and wildlife without ever getting in or on the river itself. Good water quality, high scenic qualities, and abundant wildlife draw people to the river. Canoeing has steadily gained in popularity over the last 15 years, but it seems to have leveled off recently. This leveling off has primarily been due to the weather and fluctuating river levels. The majority of campers in the county areas were once from Hamilton County, but the Boone River has recently been attracting more and more nonlocal recreationists (Hamilton CCB, 1985).

Irrigation is the primary consumptive use of the river. There are five authorized direct withdrawals from the Boone River as a primary or secondary water source. Four of these five permits are for irrigation uses, two of which occur within the PWA. The other withdrawal is for a dewatering process for material production (IDWAWM, 1985).

Rivers can accept and naturally assimilate certain amounts of wastes without significant disruption to plant and animal life. The major sources of wastewater discharge into the Boone River are the cities of Eagle Grove and Webster City. Their wastewater treatment facilities were constructed in 1978 and provide advanced treatment to remove high levels of ammonia that these relatively large population centers produce to the extent that the river cannot naturally assimilate. Other cities discharging directly into the Boone River are Britt, Corwith, and Goldfield. Cities within the Boone River Basin which discharge wastewater into tributaries of the Boone River are Wesley, Renwick, Kanawha, Thor, Clarion, and Woolstock. These smaller cities have standard secondary wastewater treatment facilities which provide adequate water quality protection. In fact, no violations of Iowa Water Quality Standards were found during a study of Boone River water quality conducted by the Hygienic Laboratory, University of Iowa in 1981.

Most rural people and people of Webster City deriv drinking water from wells into groundwater. Rivers are an important source for recharging underground water supplies. Since rivers and underground water or aquifers are interconnected, preventing excessive contamination of either can assure a continued supply of good quality water for those who are dependent on them.



CHAPTER THREE
RESOURCE ANALYSIS

e Boone River Valley is rich in natural and cultural sources which play an important role in making it the cial place that it is. A resource analysis was conducted dentify and study the different resources and their errelationships. A good understanding of the resources necessary to establish priorities for protection and nagement strategies within the Boone River Protected ter Area.

resources studied in this project include: Natural ources: Geology Soils Water Land Cover/Land Use Wildlife Ecological Features Visual Resources Cultural ources Indian Settlements Mill Sites Descriptions of esources follow.

Geology

Iowa is divided into seven landform regions. The region located in the northcentral portion of the state is known as the Des Moines Lobe, sometimes called the "Knob and Kettle" region. This area was covered by the last continental glacier of Wisconsin Age. Geologists estimate this last ice sheet entered the state 14,000 years ago, and left 1,000 years later leaving a thick blanket of glacial till covering older glacial deposits and bedrock. The Des Moines Lobe provides the only view in the state of landscapes actually shaped by ice of the Pleistocene glaciers with little modification since then (Prior, 1976).

The Boone River was developed from meltwater channels as the glacier receded northward with the advance of a

milder climate. Its broad stream valley is an indication that the volume of water was considerably more during the glacial age than we find today (SCS, 1984).

The Boone River area is underlain by stratified sedimentary bedrock of the Mississippian and Pennsylvanian Age. For the most part in Hamilton County, the underlying geology is covered with a thick mantle of glacial drift, but along the banks of the Boone River the underlying formations are visible. The landscape above the Tunnel Mill bend is underlain by the Osage Series of the Mississippian Age which contains: a) Warsaw Formation consisting of gray dolomitic shale, dolomite, and many geodes; b) Keokuk Limestone; and c) Burlington Limestone.

The area below Tunnel Mill bend is underlain by the Des Moines Series Cherokee Group of the Pennsylvanian Age. It contains cyclic deposits with shale, clay siltstone, sandstone, and thick coal beds with minor but consistent limestone beds.

Both limestone and coal were once quarried or mined along the Boone River. Limestone was quarried near Bell's Mill and various other places along the river. Coal was also mined up and down the Boone River, but primarily near Tunnel Mill and below.

Currently, oil exploration is being conducted near the Boone River. This exploration is concerned with possible clastic sediments, including silts, sands, and shales associated with the Precambrian rifting along the midcontinent Gravity Anomaly (IGS, 1985).

Soils

The Boone River Valley's physiography, drainage patterns, and steepness are the basic characteristics that create complex soil patterns. Soil types within the PWA study area were identified from the 1983 Hamilton County preliminary field sheets of the Soil Conservation Service.

The predominant soil association which occurs along the Boone River is the Hayden-Storden-Hanlon Association. A distinct feature of the association is the contrast in relief between the valley sides, adjacent benches, and bottomlands. The valley sides consist of very steep soils, the benches have nearly level to gently sloping soils, and the bottomlands contain nearly level soils. The very steep soils have many ravines and gullies that cut back into the uplands. Slopes range from 0-50 percent.

The Hayden-Storden-Hanlon soils were formed in glacial till on the uplands and alluvium on bottomlands. Hayden soils are well drained and are on gently sloping ridgetops and very steep sideslopes. Storden soils are well drained and are on moderately sloping to very steep knolls and sideslopes. Hanlon soils are moderately well drained and are on nearly level bottomlands. The minor soils in this association are the poorly drained Coland and Spillville soils found on the bottomlands; moderately well drained Terril soils found on the footslopes; and the well drained Wadena and poorly drained Cylinder soils found on the benches.

The nature of each association, expressed in the kinds of soils and their arrangements, governs its suitability. The Hayden-Storden-Hanlon association includes many soils that are better suited to pasture or forest. The steep soils in this association are poorly suited for cultivated crops. Slope and the erosion hazard are the major limitations. The soils on bottomlands and benches are well suited for cultivated crops. The principal management concerns on bottomlands are flood control and drainage. On benches, some of the soils have moderate to low available water holding capacity and are slightly droughty unless summer rains are frequent. Fields are often small and irregular in shape (SCS, 1984).

Soils within the Boone River PWA were classified into three categories based upon their suitabilities and limitations for construction and agricultural purposes as identified by Highland, et al (1973). These categories are: **1) Natural Area; 2) Prime Agricultural Land;** and **3) Nonintensive Agricultural Land.** The suitabilities and limitations for construction are defined in terms of compatibility for developments such as houses and other buildings, septic systems, and roads. Agricultural criteria include Corn Suitability Ratings (CSR) and Animal Unit Day (AUD) ratings for livestock grazing.

The Natural Areas include soils that have: 1) severe limitations for construction; 2) poor CSR; and 3) poor to fair AUD ratings for livestock grazing. Areas with moderate limitations for construction and poor CSR and AUD ratings are also in the Natural Areas category. The land within the Natural Areas category is commonly located on very steep hillsides, bluffs, and ravines.

The Prime Agricultural Land category includes areas that have good to fair CSR and slight to moderate construction limitations. These areas are typically the relatively flat bottomland fields that are used for row crop production. The AUD rating is not considered in this classification since the CSR is definitely the dominant agricultural use indicator.

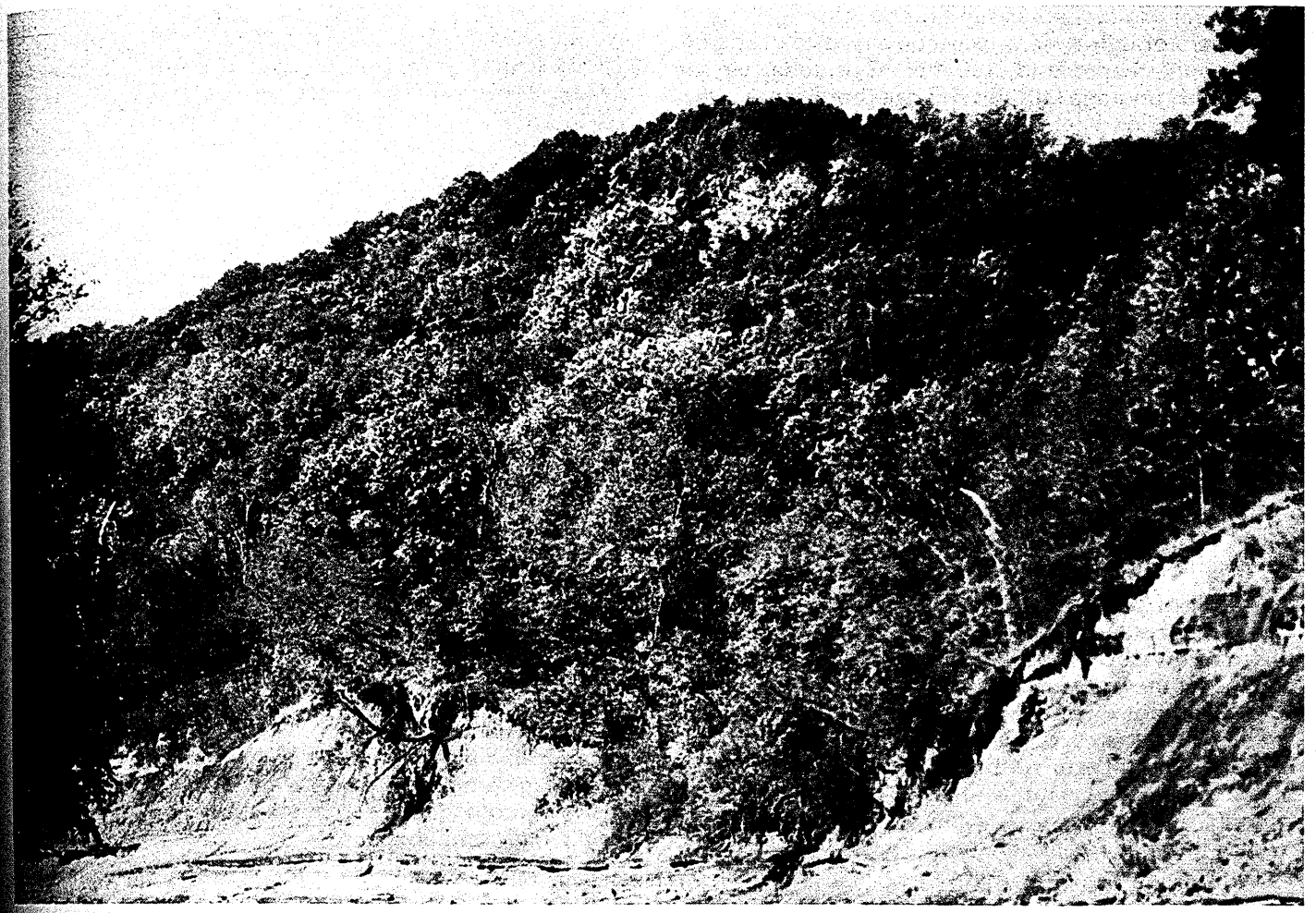
The Nonintensive Agricultural Land category are areas that have moderate to severe construction limitations, fair to poor CSR, and good AUD Ratings. These areas are typically located on rolling topography with slight to moderate hillside slopes.

Water

The Department of Water, Air and Waste Management (DWAWM), Iowa Conservation Commission, numerous Boone River anglers, and other recreationists have found that the Boone River has excellent water quality. Standards have been set to monitor and maintain that quality for its continued use and enjoyment.

A protected low flow of 24 cubic feet per second has been established for the Boone River. According to DWAWM's Administrative Code 900—52.8, the purpose of a protected flow is to protect and maintain adequate water supplies for ordinary household and livestock use; fish and wildlife use; recreational use; in-stream wasteload assimilation and pollution control; beneficial water use needs in the watershed; preservation of aesthetic values; and other uses of a public nature.

According to **Iowa Fish and Fishing** (Harlan and Speaker, 1969), the Boone "is one of the most important producers of smallmouth bass in the Des Moines River basin." This is one indicator of its excellent water quality. A water quality study of the Boone River and selected tributaries was conducted during February 1981 by the State Hygienic Laboratory, University of Iowa. The primary purpose of the survey was to assess water quality during low flow



conditions and determine the impact of major wastewater discharges on water quality. Results of the study indicate that the municipal wastewater treatment plants of Eagle Grove and Webster City had no significant impact on Boone River water quality. The overall water quality of the Boone River during the study was excellent. Compared to a previous winter study performed by the Hygienic Laboratory in 1976, an improvement in ammonia nitrogen was found downstream from Webster City and may be attributed to that city's new wastewater treatment plant. The Department of Water, Air and Waste Management currently classifies the Boone River as a Class B Warm Water River; but they are in the process of reclassifying the river to include High Quality Resource Water and Class A designations. These classifications set standards for water quality protection of the Boone River any time the stream flow equals or exceeds 4.0 cubic feet per second.

Class A water gives greater bacterial protection to those segments receiving at least moderate use as a primary contact recreation water. Primary contact means any recreational use in which there is direct human contact with the water, such as swimming, canoeing, tubing, diving, and wading.

High Quality Resource Water designation means that a river or lake has been identified by the Iowa Conservation Commission as having exceptional recreational and/or ecological significance. The emphasis is to afford protection to the physical and/or biological integrity of the waters since the chemical quality may not be exceptional.

Land Cover

All land uses affect the type and quality of vegetation or land cover. People owning property along the Boone River use their land in a variety of ways. For example, they live on it, raise crops on it, graze livestock on it, harvest timber on it, plant trees on it, and grow vegetable gardens on it. Some people do not do much more with their property than occasionally walk over it to enjoy its natural beauty.

To understand the land cover of the Boone River area today, it is necessary to look to the past. Huge expanses of prairie existed at the time of settlement. They were maintained by natural fires and fires set by native Americans to hunt buffalo. Fires were controlled as the area was settled, so some prairies perhaps converted to woodlands.

Most early settlers preferred to live in or near the well-drained woodlands along rivers, since most of the open prairies were poorly drained and remained too wet for choice development areas. The woodlands provided a source of shelter and fuelwood. As timber was cut for fuel and building material, stumps were cleared for pasture or cropland. The clearing that occurred during this period was a slow, steady force in the decline of the timber base in the area.

Most prairie land was converted to cropland between 1910 and 1920, and many of the initial problems associated with draining prairie land had been solved. Economic conditions following World War II made increased agricultural production profitable. The only remaining land for

agricultural production was in timber. As a result, most land level enough to farm was converted to cropland, leaving only steeper land in timber. Thus, today we see trees mainly on steep hillsides and river bottom areas that are prone to flooding.

During this same time period following World War II and into the late 1960's, we saw another trend that had an effect on timber in the Boone River PWA. Beef cattle production became an important part of agriculture, and there were many "cow-calf" operations in the area. In such operations, the cows calved in spring and they were kept together until winter at which time calves were sold or put into a feedlot. During spring, summer and early fall, farmers needed a place to keep cows and their calves. Most of the land that would be good for grass production was in crops; therefore, many operators found that woodlands made acceptable summer pasture. In most cases, this timber pasture was not good in terms of grass production, generally requiring two to five acres to take care of a cow and a calf for a summer. But it had little or no other value; thus, it seemed good land use.

The result of years of pasturing timber ground has left many timber stands in poor condition. Soil compaction caused by livestock, coupled with cattle eating or trampling most of the desirable seedlings, has left many timber acres with poor quality. Many owners like the looks of woodlands that are grazed because they are open and park-like with little or no brush. When timbers are no longer grazed and natural regeneration is allowed to come back into an area, many people feel timbers become junky or brushy and decline in quality — actually, the forest is regenerating itself.

In looking at timber, it is necessary to keep in mind the history of clearing that has removed some of the better timber sites from production and intensive grazing that has taken place. About 5,500 acres of timber are currently along the Boone River. Although the original area of timber is unknown, we can speculate that its reduction generally follows the trend for Hamilton County.

Records of the original land survey, made during the 1850's, indicated there were 19,500 acres of timber in Hamilton County. The U.S. Forest Service made the next estimate of 9,000 acres in 1954; and another in 1974, at which time there were 6,200 acres. This loss of 13,300 acres of timber in Hamilton County between 1850 and 1974 is a 68 percent reduction.

Aerial photographs taken in 1979 were used to identify various land uses and land cover. Overall quality of land cover was also determined from the photos. In addition, sites were visited by an ecologist and botanist from the Iowa Natural Areas Inventory staff to verify information interpreted from the aerial photos. Table III-1 lists the land cover categories and their respective number of acres in the Boone River PWA. The following sections describe the categories.

Woodlands — A total of 5,215 acres of woodlands are in the Boone River PWA. They are divided into four categories according to their age, species composition, landscape position, and condition/quality. The upland timber is divided into two categories, mature and immature woodlands. The bottomland timber is on the floodplain and the fourth category is disturbed woodland.

Table III-1 Land Cover Categories

Land Cover	Acres
Mature Woodlands - Undisturbed	671
Mature Woodlands - Disturbed	524
Immature Woodlands - Undistrubed	713
Immature Woodlands - Disturbed	2,330
Floodplain Woodland	977
Savannah	264
Cropland	598
TOTAL	**6,077**

NOTE: Total PWA acreage is 6,338. The 261 acres not included in the land cover categories are surface waters (Boone River, Briggs Woods Lake, and farm ponds.)

Mature Woodland — The Boone River PWA contains 1,195 acres of mature woodland. This category includes two plant associations, maple-basswood and oak-hickory. It was identified from the aerial photographs by a large percent of large canopy trees with a gradation of smaller canopy trees. The species of trees found in a mature woodland depend primarily upon the direction the hillside faces.

Major species found on the moist north and east facing slopes are hard maple, basswood, red oak, and some white oak. Understory trees and shrubs are young maple, basswood, with some ironwood, serviceberry, cherry, and American hornbean. Spring flowers include Virginia waterleaf, dogtooth violet, Dutchman's breeches, may apples, wild ginger, and phlox.

Unlike some of the other forest stands, stands on north and east facing slopes are in a state of transition. Oaks found in these stands require full sunlight to be maintained, but hard maple and basswood are shade tolerant and can regenerate in the shade of existing trees. What now exists as a mixed hardwood stand of oak, maple, and basswood will probably climax as shade-tolerant maple-basswood, as these species become established under the oaks.

Oak-hickory plant associations occur on dryer south and west facing slopes. Dominant species are bur oak and shagbark hickory. On sites where soils or moisture are better, scattered white oak stands exist. Subordinate trees include maple, red oak, cherry, and basswood. Understory is dominated by ironwood, serviceberry, immature cherry, maple, and hickory. Ground cover consists of violets, Dutchman's breeches, anemones, and phlox.

Immature Woodlands — Two kinds of immature forests exist along the Boone River which differ in their origin. Large trees could be found in both but are not a dominant component of the woodland. On the aerial photographs, these woodlands appeared with a fine even texture which indicates a younger age. The Boone River PWA contains 3,043 acres of immature woodlands.

The first kind includes areas that were originally forests and have been disturbed by natural or human causes and are now in a process of returning to a woodland. Whereas the major characteristic of a mature forest is a dense, high canopy, the main characteristic of an immature forest is a dense, low tree canopy or some large trees and a dense understory. The understory often consists of thorny or weed species such as honey locust, gooseberry, box elder,

and raspberry. The overstory will be variable and depends upon the level of disturbance and the direction the hillside faces.

The other type of immature forest includes those that developed on areas that were originally prairie at the time of settlement. These are usually on dry areas where prairie and savanna communities (grassland with scattered oak trees) were once maintained by fire. The overstory trees that occur are bur oak, white oak, and hickory. The understory consists of sumac, red cedar, slippery elm, and ironwood.

Immature floodplain woodlands are characterized by dense, low growth without an established overstory canopy. They may consist of dense stands of immature cottonwood, willows, silver maple, and box elder, associated with gooseberries, nettles, and clear weed.

Floodplain Woodland — The floodplain plant community is characterized by partial to dense canopy. It is dominated by cottonwood, silver maple, and willow. Subordinate trees include ash, walnut, elm, and basswood. The understory consists of immature willows and cottonwoods. Their densities will vary with the frequency of flooding into these river bottom woodlands. Topography maps were used with the aerial photographs to identify floodplain woodlands. The Boone River PWA has 977 acres of floodplain forest.

Disturbed Woodlands — These woodlands are subjected to various kinds of natural and man-induced disturbances that disrupt their natural succession towards a climax forest stage. Examples of these disturbances are flooding, fires, livestock grazing, and timber harvest. South and west facing slopes seem to have been more affected by grazing than some of the other timber sites. Grazed woodlands are easily identifiable on aerial photographs by their jagged boundary. Five hundred and twenty-four (524) acres of mature woodlands and 2,330 acres of immature woodlands are disturbed in the Boone River PWA.

Marshes — The original prairie land of north-central Iowa was interspersed with thousands of pothole marshes. Only about 1 percent of Iowa's original mars remains today. The other 99 percent has been drained or filled to make way for agricultural, industrial, and residential developments.

Hamilton County is in Iowa's original prairie-pothole region. These marshes were primarily located outside the Boone River Valley in the more flat terrain. Vegetation in the marshes typically consists of cattails, bulrushes, arrowheads, common reed, pondweeds, duckweed, coontails, water milfoils, and bladderworts. Some marshes are occasionally formed along the Boone River when it changes its course and the previous river bend is cut off from the main water flow. Marsh vegetation will grow in some of these old oxbow areas, but it is rapidly buried by sediment. Trees such as willows and cottonwoods will then grow in these areas to create floodplain woodlands. A few small marshes are currently along the Boone River in old oxbow areas.

Savanna — The savanna communities are characterized by scattered oak trees with a native prairie grass ground cover that was once maintained by fire. The savanna landscape of today has a bluegrass or bromegrass ground cover and is maintained by livestock grazing. The Boone River PWA contains 264 acres of savannah. Red cedars, sumac, and brambles may become established in these areas if the soil is disturbed by erosion or overgrazing.

Cliff and Ledge Communities — These are typically rocky, steep areas with a plant cover ranging anywhere from 0-100 percent. Shady areas are composed of ferns, mosses, and liverworts. Columbine, cedars, and serviceberries will be found on the less shady areas. Several cliff and ledge communities are along the Boone River's bluffs.

Cropland — This land cover category includes 598 acres and consists of corn, bean, hay, and wheat fields. Some of Iowa's most fertile agricultural land is located in river bottoms. The tillable land in the Boone River Valley is no exception.

Wildlife

The Boone River Valley is home to many species of wildlife. The diversity and abundance of wildlife along the Boone River are dependent upon available habitat which provides food, cover, water, and space for living and reproduction. Each species has its own habitat requirements. Although many species show a strong need for specific types of habitat, most require a diversity of habitats for different portions of their life cycle. For example, cover requirements may vary for feeding, nesting, raising young, resting, and escaping from predators. Appendix B contains a list of mammals living along the Boone, their estimated abundance, and the habitat in which they can be found.

The Boone River is one of the last major vestiges of wildlife habitat remaining in north-central Iowa. Its valley provides a variety of habitat including large areas of protective woodland, brushy edge, floodplain oxbows, grassy old-fields, and abandoned pastures in various successional stages. A variety of landforms in terms of

slope and orientation add to the complexity and diversity of available habitat. The river itself provides for many aquatic and semi-aquatic species.

Most forest wildlife species are abundant along this unique river valley. White-tailed deer are found throughout the area. Brushy fields, forest edge, pastures, and old-fields provide the necessary secluded fawning and resting areas and the adjacent corn fields supply an excellent food source and serve as travel lanes.

Wild turkeys are once again a common resident to the area following a successful reintroduction by the Iowa Conservation Commission. Two gobblers and 11 hens were released along the Des Moines River just below the mouth of the Boone River in the winter of 1977. Today these magnificent birds have successfully spread along the Boone River corridor all the way to Webster City. The oak forests in this region offer these birds abundant crops of mast (nuts, seeds, and berries), night roosts, nest sites, and escape and resting cover. Brushy fields and grasslands produce an excellent diversity of insects which are an important source of protein for growing turkey poults. These areas are also suitable nesting sites. Waste grain from nearby cropfields supplements the fall and winter diet.

Recently, another former resident was reintroduced to the area. In September of 1982, Conservation Commission employees released 55 ruffed grouse (approximately half of each sex) on the Boone Forks WMA. Several recent sightings by area residents and Commission personnel provide hope that the spring drumming sounds of breeding males may once again echo throughout the valley. Ruffed grouse management must emphasize interspersion of various age classes of timber within the normal range of these birds. Forest field edges and recent cutover areas (0-10 years after timber harvest) provide chicks with abundant insect and seed food sources, and low, dense protective cover. Early successional stages (10-30 years following timber harvest) provide the best breeding habitat, and mature and pole-sized timber provide the best nesting habitat and source of mast.

Ring-necked pheasants, gray partridge, and bobwhite quail are found along the upland borders of this corridor. Intensive farming practices, recent severe winters and cold, and wet springs have reduced upland game bird populations, especially in north-central Iowa. However, the maintenance of adequate winter cover in close proximity to a winter food supply such as standing corn, and the availability of quality nesting cover which remains undisturbed throughout the spring and early summer will help bolster populations of these species.

Because there are many types of habitat along the Boone River, the area is also very rich in nongame birdlife. Many nongame birds are dependent on habitat within the Boone River corridor for nesting (see Appendix C, Table C-1). Other species such as the great blue heron, are known to feed in the area, but nest elsewhere.

A survey conducted during May 1984 by the ICC, found that mature woodlands along the Boone River are home to an excellent variety of cavity nesting birds such as woodpeckers, flickers, chickadees, and great-crested flycatchers. In more open habitats, bobolinks are numerous. Yellow warblers were found in greater numbers than expected. The yellow warbler has declined over much of its range and is on the Audubon Society blue list of special concern. A list of other uncommon birds that occur in the Boone River corridor is in Table III-2. A complete list of bird species that have been observed between 1965 and 1984 at Briggs Woods, a county-owned area, is included in Appendix C, Table C-2.

Table III-2

Uncommon Birds that Occur in the Boone River Corridor

Species	Comments
Osprey	Feeds on fish, uses the Boone River Corridor during migration.
Bald Eagle	A federally listed endangered species that uses the Boone River Corridor during migration.
Cooper's Hawk	Requires wooded areas, seen in Boone River woodlands during migration.
Red-Shouldered Hawk	Few nesting pairs are known in Iowa. One nest occurs south of Boone River area. These birds undoubtedly hunt the Boone River woodlands.
Broad-Winged Hawk	A nest located in the Boone River Watershed during 1976 is one of only 9 known nests in Iowa since 1956. They may nest here again if a 200-acre block of woodland remains around the nest site.
Upland Sandpiper	A species that requires grasslands and has declined dramatically in recent years.
Least Flycatcher	A seldom seen bird of woodlands.
Loggerhead Shrike	A bird that requires shrub thickets for nesting.
White-Eyed Vireo	A rare woodland edge species.
Yellow Warbler	A small yellow bird that nests in lowland brush thickets.

The Boone River Valley also supports many species of furbearing animals, and serves as a major daily and seasonal travel corridor for adults and young of the year. Red fox, coyote, raccoon, mink, badger, striped skunk, opposum, beaver, and muskrat are common residents of this area. Small mammals, insects, berries, and a variety of succulent and woody vegetation provide this diverse group of animals with an adequate food source. Appendix B includes a listing of mammals living along the Boone River and their preferred habitat types and relative abundance.

Small mammals were trapped on the Boone Forks Wildlife Area by Conservation Commission personnel in the spring and summer of 1983 to determine abundance and diversity of these species. Common species included the short-tailed shrew, masked shrew, eastern mole, prairie and woodland whitefooted mouse, meadow vole, and meadow jumping mouse. A very rare species (endangered in Iowa), the woodland vole, was found in this area. More information on this animal is found in the Ecological Features section of this chapter and in Appendix M.

Mist nets set for bats in early June of 1983 were unsuccessful probably due to rapidly falling temperatures on both

evenings which reduced insect and bat activity. However, Dr. John Bowles, mammalogist for Central College in Pella, predicts that species most likely to be present are the little brown bat, big brown bat, silver-haired bat, and red bat. Species that may be present include the hoary bat, Keen's myotis, eastern pipistrelle, and evening bat.

Fish

A survey of fishes and aquatic habitat of the Boone River was conducted on July 14, 15, and 18, 1983 by the ICC. The area surveyed was from Webster City to Vegor's Bridge.

Aquatic Habitat — The quality of aquatic habitat in the Boone River from Webster City to the confluence is generally good. Nearly the entire length of shoreline is vegetated with tree growth, thus the streambank is for the most part stable. Badly eroded banks (six areas) do exist, however. All shoreline erosion is associated with intensive row crop immediately adjacent to the streambank.

The composition of the bottom is of a high quality for sport fish with sand, gravel, and rock rubble predominant. The upper two-thirds of the river is largely rock and gravel (River Side Park—Tunnel Mill Bridge). The lower third (Tunnel Mill—Vegor's Bridge) is made up mostly of sand and gravel.

A variety of specific habitat types exist in the river. Riffle areas obviously show the same trend as the bottom substrate. Riffle areas and limestone outcroppings are most abundant in the upper two-thirds of the river. The frequency of occurrence of smallmouth bass reflects their preference for this type of habitat. Habitat in the lower third is dominated by snags and sand or gravel bars.

Several permanent and intermittent streams flow into the Boone River along its entire length. These tributary streams are important as both spawning (i.e. smallmouth bass) and nursery areas for sport and nongame fishes.

Fish Populations — The species of fish found and their abundance reflects as well as anything the quality of habitat in the Boone River. A total of 37 species of fish was collected which included fish from eight different families.

The major sport fish found in the Boone River are the channel catfish and smallmouth bass. Other sport fish of minor importance include walleye, northern pike, flathead catfish, rock bass, and black bullhead. Walleye and northern pike are probably more common during springtime months as they move from the Des Moines River up into the Boone in an attempt to spawn.

Channel catfish were collected at all study sites. A good distribution of length frequencies was evident, indicating several year classes and successful natural reproduction. Total length of channel catfish ranged from 5.2 inches to inches. Two flathead catfish were caught during the survey. The largest fish weighed approximately 20 pounds the smaller weighed 6 pounds.

Smallmouth bass were also collected at all sampling sites. Much like the channel catfish, several sizes of fish were captured, indicating varying ages of smallmouth and successful reproduction. Total length of bass ranged from 4.3 inches to 17 inches.

Species listed as rare or uncommon that at one time have been reported in or near the Boone River were not found during this survey.

Appendix D lists the fish species and their relative abundance in the Boone River.

Ecological Features

Rolling expanses of tallgrass prairie, herds of elk and bison, flocks of sandhill cranes, more than two milion acres of wetlands, magnificent stands of oak-hickory forest, clear meandering prairie streams — all are gone forever from Iowa's landscape. Yet today in central Iowa, we have reminders of our remarkable ecological heritage. Prairie remnants reveal natural processes which created some of the world's most productive soils. Dense woodlands provide a home for numerous rare and threatened species. These treasures provide scientific, educational, and cultural benefits for all Iowans.

A number of rare or unique ecological features occur along the Boone River. These elements or features are most important because of their rare occurrence within the immediate area and the entire state of Iowa. These include:

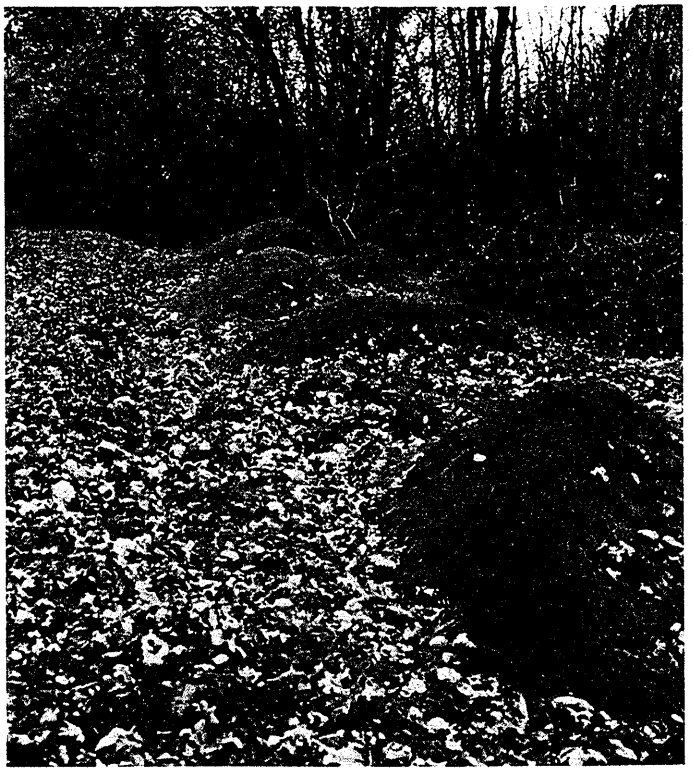
1. Rare, endangered, or threatened species

a. A rare Showy Lady's-Slipper Orchid (Cypripedium reginae) was found along the Boone River. This plant is critically endangered in Iowa and threatened throughout its range. There are only three known sites in the state at this time.

The showy lady's slipper grows to a height of two feet. Its stem is densely covered with sticky hairs that yield an acid that causes blisters and inflammation in eight to ten hours on many people. This plant's leaves are commonly seven inches long, four inches wide, elliptic in shape, and acute at the free end. Leaf veins are conspicuously parallel. A plant has one to three flowers with a white- or pink-tinted lip that appears inflated and is two inches long. The sepals are longer and broader than the petals. This is easily one of the most beautiful of all wild flowers. Its growing range extends from Newfoundland to Minnesota and south to Georgia. It is mostly found in swamps and wet woodlands (Palmer, 1949).

b. An endangered Woodland Vole (Mycrotis pinetorum) was found by a Conservation Commission's wildlife biologist during small-mammal trapping in the summer of 1983. This is only the fourth recent record in Iowa known for this species. This vole lives in undisturbed woodlands which are disappearing in Iowa; therefore resulting in the decline of this species. Appendix G contains a description of the woodland vole and its habits, as presented by Schwartz and Schwartz (1981).

c. Colony of Eastern Mound-Building Ants (Formica exsectoides) consisting of several hundred mounds, occurs in an oak-hickory forest on a ridgetop overlooking the Boone River. These ants form colonies which consist of numerous mounds in open forest clearings. The average mound is two feet high and six feet across, and the ants commonly work the ground to a depth of more than five feet (Christensen and Quick, 1970).



2. Special plant communities

a.Cliff and ledge plant communities occur on steep, sometimes vertical slopes with thin soils. These communities are not common in central Iowa and contain highly specialized plants such as ferns, mosses, and liverworts.

b. Hill prairies are an unusual plant community in Iowa even though 85 percent of Iowa was prairie at the time of settlement. These "goat prairies" usually have shallow dry soils on steep slopes, and are remnants of larger hillside prairies which have been invaded by woody species. A few small hill prairies are the only known native prairie in the Boone River study area.

c. Good examples of lowland and upland woodlands are found along the Boone River. Surprisingly, there is not a lot of lowland, or floodplain, forest along the Boone River because of the narrow topography of the floodplain and cropground development in the river bottoms. Floodplains offer a rich diversity of habitat for wildlife. Mature undisturbed upland woodlands are also rare along the Boone River. This is because most woodlands were once grazed, are presently grazed, or the timber has been continually harvested. Clearing of woodlands for cropfields is also a major cause of this scarcity. Undisturbed woodland is often the home for some of Iowa's rare or endangered plant and wildlife species.

d. Marshes or wetlands occurred frequently in central Iowa before settlement. Marshes are also home for unusual plants and animals. Only a few marshes associated with old oxbows are in the Boone River PWA.

Unique ecological elements or features such as those discussed above are difficult to find in such a large area with the majority of land being privately owned. It is hoped that over time with continued interest and curiosity by landowners, that more special plants and animals will be found to occur along the Boone River. Studies will continue on public-owned lands. The Boone River Valley is a rare depository of that which was once wild and prevalent in central Iowa. Those unique elements recorded thus far are only a beginning.

Visual Resources

A rich scenic quality is one of the Boone River's most valuable natural assets. The visual landscape is complex and the relations between landforms, vegetation patterns, flowing water, and human activities are components of the Boone River's scenic character.

Landforms, as related to streams, are essentially containers —envelopes of space. The landforms on either side of the river and the amount and type of enclosure greatly affect the picture or image we see. The Boone River for the most part is visually enclosed by its banks. How much and what can be seen beyond these banks depends upon the topography and density or occurrence of vegetation. The most visually exciting landforms along the river are the steep ridgetops and bluffs which, in some places, rise to 100 feet or more above the river.

Vegetation patterns emerge from a mixture of general land cover types such as woodland, floodplain vegetation, pasture, row crops, and hay fields. Amounts of different cover types, their relationship to one another, position upon the terrain, and linkage to the river play a variety of visual roles in the landscape. Plants and cover patterns in the river landscape are usually subordinate to the landform. Plants can, however, be visually dominant, becoming distinct features or functioning to define space or creating the visual enclosure. Visual enclosure along the Boone River is usually provided by a combination of the river banks and adjacent vegetation. Seasonly, vegetation may dominate the scene.

The presence of a river usually occupies a small percentage of total area but it is dominant because of its visibility, its movement, reflections, and its contrasts to adjacent terrain. A river's pattern or path may be braided, meandering, sinuous, or straight. The movement of water along that path also contributes to the visual image. Rapids, riffles, slow-moving currents, and placid waters all have varying visual impacts to visitors. It is the varying combinations which add to or subtract from the visual image of the water element in the landscape (Litton, 1977).

Human use can produce patterns that are compatible with the river landscape. Agriculture patterns are primarily from changes in vegetative cover and are frequently geometric. Topography is altered in minor ways. Fields usually occupy flatter lands which reduces their visibility as compared to land uses on hillsides. Occasional glimpses of cropfields along the Boone River are reminders of Iowa's basic heritage.

Some forestry practices are visually compatible with the river landscape, while others are quite obtrusive. Selective cutting makes subtle visual modifications. Clear cutting is or can be obvious. The fit to the landscape can be good, bad, or indifferent, but gostry aims to maintain full cover on sites unsuitable to clear cutting.

Other visual reminders of human use along the Boone River are the bridges and power lines. Nine bridges cross the 25-mile stretch of river. They all serve as landmarks to canoeists, anglers, and other river users.

The elements described above, in varying combinations, make up scenic quality. Having already determined that the Boone River is one of the most scenic rivers in the state, it was not necessary to evaluate or compare the scenic qualities along it. Instead, the following three visual factors were addressed in the PWA study:

1. **Most Often Seen Area.** This area was identified from topography maps and field observation. This is the area most commonly seen from the river. When on the Boone River, there is an incredible sense of enclosure which is a combination of relationship between varying landforms and vegetation. This area contains major views and the significant features described below.

2. **Major View.** A major view is a broad landscape or spectacular view that is looked toward or kept in sight. It is usually comprised of a number of features that create a particularly striking scene. It is these areas that make you reach for your camera.

3. **Significant Visual Feature.** These are features which are visually dominating and grab your attention. They are often distinctive elements such as rock outcroppings, interesting plants, huge boulders, water riffles, or water falls.

...ural Resources

...patterns of settlement in Iowa are recorded repeated-...history as beginning in the timbers along rivers and ...later were the prairies "broken" and traveled. ...quently, most culturally and historically interesting ...in Iowa took place along the river and stream ...ors in the state.

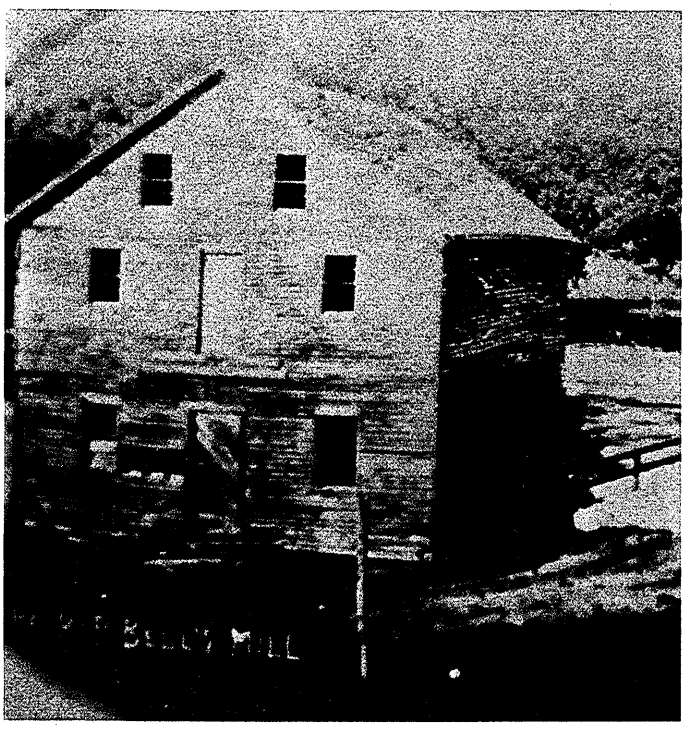
...oone River is rich in historical and prehistorical ...es. The historical period began with written record ...udes the history of settlement and the many mills ...e river. The mills were located in the most ...ique spots on the Boone River surrounded by ...oods and running water.

...of to shelter and a loaf of bread were the first ...the pioneer home. The trapper or hunter ...ake his corn cake over the hot ashes of a ...and find the sky is blue and the thick leafy ...the woods enough for a shelter. But the ...eeded a home; and a home meant a woman, ...our walls, a roof, and bread. So it was that the first activities were sawmills, then gristmills." (Kantor, 1912)

The Boone River provided abundant water power. The necessary machinery was carted by oxen from the eastern boundary of the state, and the production of boards and shingles began. Sawmills were expanded by adding gristmills with two burrs, one for wheat and one for corn, and white bread was no longer a luxury.

Settlers could get more than livestock feed and flour when they made a trip to the mill. Some wooded areas along the Boone River were underlain with coal, of which some veins were exposed on the land surface. Settlers could dig their own coal for as little as one dollar per load. People also cut and hauled firewood from woodlots established in the wooded river corridors.

The first mill in Hamilton County was located three miles north of the Boone River's mouth. This was called Bruce Mill, and was built in 1851 or 1852. Nothing more is known about its existence or demise.



The second mill in Hamilton County was built by David Eckerson, a wealthy Methodist preacher. It was built approximately 1853 near the site of Bell's Mill. It was a gristmill and at first had corn burrs which also ground buckwheat. He later installed wheat burrs and had a flourishing business. The mill was run with a wooden overshot waterwheel. This mill changed hands many times — from David Eckerson to Joseph Bone to John Atherton to Benjamine Bell and his son John Bell. On the night of March 2, 1888, Benjamine Bell died, and the same night a flood and ice carried away the dam, stopping the wheels of the mill forever.

The third mill on the river was moved from Polk County by Andrew Groseclose, who came here and built a dam across the river in 1852. The mill was moved later in 1853, and it was set up by Lewis M. Crary and William Strickler. The mill itself was a small frame one-story building, which finally caught fire and burned. It was never rebuilt.

As the winter passed, the fear of the ice gorge arose in the millers' hearts. Only those who lived in a miller's household knew the apprehension that surrounded the opening of the river. Often a warm night in early March broke up the ice and the swelling, menacing roar would awaken the family. Great cakes of ice, weighing many tons, carried by the swollen flood would pile up in the bend of the river and wedge against the bridge piers and mill foundation. The ice would eventually break loose and smash into the corner of the mill that stood in the river. Once members of the Bone family helplessly stood on the bank and watched as the entire end of their mill, from roof to foundation, fell out into the stream. Fire could be fought with water, but water and ice were impossible to fight. The greatest enemy of the mill was the ice gorge.

A map of the state of Iowa, dating back to 1856, gives the location of a mill called Williams' Mill. Thomas Williams' first mill washed out, and he moved downstream about 200 yards and started another dam and mill. He sold it to Lambert Sternberg, and Lambert in turn sold the mill to Jay Sternberg in 1863. The mill was on the east side of the Boone River and on the south side of Bever's bridge. Jay Sternberg sold the mill to John Ross in 1868. Ross was found murdered in the wheel pit. A nephew was suspected, brought to trial, and acquitted. This trial was the first trial for murder that was held in the first Hamilton County Courthouse. The mill was again run by Jay Sternberg for another year until he sold it to James W. Kimball. Kimball made several improvements and sold half interest to his son Ben. When Ben died, his share was sold to Joseph Bone whose name the mill is known by even today. Bone later became the sole owner of this mill. He also acquired Bell's Mill in 1867 and became known as the best miller on the Boone River. Bone employed Adam MacKinlay as a miller, and he married one of Bone's daughters. In 1880 the mill was known as Excelsior to avoid any confusion with the other mill operated by Bone. The company that ran both mills was at the time called Bone and MacKinlay. A post office was established at the mill on May 28, 1888, with Adam D. MacKinlay as the postmaster. It was named Tremaine for Ira H. Tremaine who owned land near the mill. Her daughter, Minnie Tremaine, married a Bone. At some time, the mill was converted to steam power and in January 1899, the boiler exploded which destroyed the mill. The post office was discontinued at that time (Kantor, 1912).

Tunnel Mill is the most unique of the 17 mills that were located along the Boone River. Robert Watson, in 1852, constructed a 400-foot tunnel through a hillside around which the Boone River flows. He made it using the crudest of tools and pocket compass. Digging from both ends they were only 18 inches apart when they met in the center of the tunnel. This allowed him an 11-foot fall of water — head and fall together. The tunnel was lined with native three-inch planks and was supported by eight to ten-inch posts. It needed constant repair as the water rotted the boards. Watson sold the mill for $6,000 in 1867 to Lyman Perry who was joined by his brother Gilbert in 1870. On November 14, 1889, after grinding buckwheat for three weeks, the mill was shut-down at 7:00 p.m. because of a hotbox. At 2:00 a.m. Solomon Dick and his sons, awakened by a glare in the sky, hastened to awaken the miller. They were too late. All that remained of the once-flourishing mill was a pile of smoldering embers (Nass, 1976).

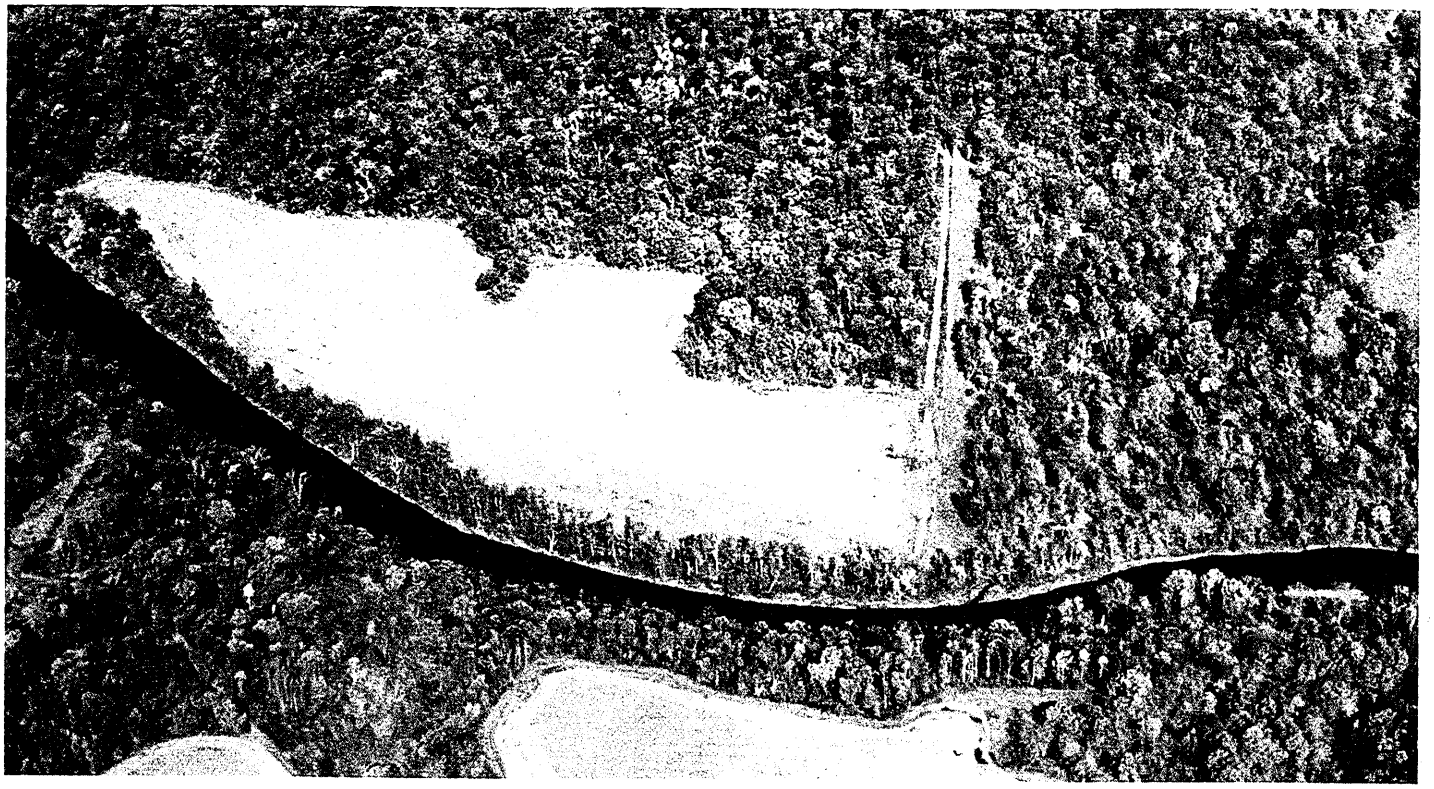
In 1855, Sumler and Walter Willson built a sawmill near the site of the old Chase Mill in Webster City. The Willsons sold it to Chas. Stoddard and W. S. Pray. A little later the flourishing industry added a furniture factory. The only coffins used in the settlement were made here and during a typhoid epidemic the small force of cabinet makers worked day and night to fill the orders for coffins. In 1868 Stoddard and Pray sold the mill to John Hill. In 1873, Hill sold a half interest to Judge D. D. Chase, and the other half was sold to him in 1877. In the 1880's, it was abandoned and stood for many years as the last mill on the river (Kantor, 1912).

History of the mills tells much of the story of how Europeans settled the Boone River Valley. Just as the settlers found this area appealing, so did the Indians who lived here before them. Along the Des Moines River and its tributaries, native Americans lived for centuries. During that time, settlements would have been temporary or permanent and would have included subsistence activities such as hunting, foraging, fishing, and/or farming. Upon their arrival in 1850, the settlers probably encountered the Fox and Sauk Indians. There were, however, other tribes who temporarily claimed this land as the white man

displaced them into the west. These tribes included the Ioway, Oto, Missouri, Omaha, Winnebago, Pottawattamie, Ottowa, Chippewa, and Sioux. In fact, from the opening of the territory in 1832, only 20 years lapsed before white man possessed all of Iowa by treaty (Ohlerking, 1975).

Several landowners along the Boone River today remember stories told by their grandparents about Indians in the area. Some stories recount Indian children coming to play with them when they were young, while other memories include Indians coming to beg, steal, and trade for food and supplies. Mounds and artifacts exist along the Boone River but most have not been studied by archaeologists. Those areas that have been studied indicate that most are from predecessors of the tribes mentioned above. They belong to the prehistoric period of native Americans known as the Woodland Period. Most sites tested are from Middle and Late Woodland Periods which dates approximately from 600 A.D. to 1000 A.D. Studies show that they are habitation sites, campsites, burial sites, and mounds along the Boone River. Some small mounds have burial functions and others may be symbols of their spiritual beliefs — of the interrelatedness of humans with

resources of the universe. These areas and those that have not been studied are an extremely important resource. Each mound and campsite contains information that may scientifically help us to someday understand how prehistoric people in central Iowa lived and interacted between themselves and their environment. This information can also provide a comparison for the way we live and interact with our environment.



CHAPTER FOUR
BOONE RIVER PWA ZONES

The Boone River PWA consists of 6,338 acres, with 5,180 acres in private ownership and 1,158 acres in public ownership. Ninety-one (91) private landowners are within the area. Protection zones were developed from the results of the resource inventory, described in Chapter Three. The inventory presents the Boone River resources as single topics. This information was synthesized in order to understand the interrelationships, for example, some of the best examples of mature woodland occur on the steep slopes with sensitive soils. This synthesis produced three categories that generally identify the range of resource conditions; reflect resource suitabilities and limitations; and describe the need for different levels of resource management and protection. The three categories are described below.

1. **Primary Protection Area -** These are the most sensitive areas in the Boone River Valley, and are least adaptable to disturbance without damaging the character of river. High levels of resource protection are desirable to maintain the integrity of these resources. It consists of 1,576 privately owned acres and 266 acres of public land, which totals 1,842 acres.

   This area contains resources unique to the area and/or state; species which are "threatened" or "endangered"; and resources susceptible to negative impact due to disturbance. Resources included in this area are:

   a. Unique ecological features such as the ant hills, endangered vole habitat, the endangered orchid, and the best examples of plant communities.

   b. The "most often seen area" from the river which when properly managed will (1) maintain the scenic quality of the river; (2) maintain or establish a vegetative strip next to the river to protect water quality and stabilize the bank; and (3) provide a continuous wildlife corridor.

   c. Prominent views and significant visual features.

   d. Soils identified as most suitable for Natural Areas that overlapped with one of the above resources.

2. **Secondary Protection Area -** These areas are identified as less sensitive than the Primary Protection Area. They are not the wooded steep bluffs next to the river, but rather the wooded uplands, savannas, tributaries, and intermittent streams further back from the river. These areas contain significant resources worthy of some form of protection. This category contains 3,065 privately owned acres and 806 acres of public land, which totals 3,871 acres. Resources in this area include:

   a. Soils identified as most suitable for Natural Areas which did not fall in the Primary Protection Area.

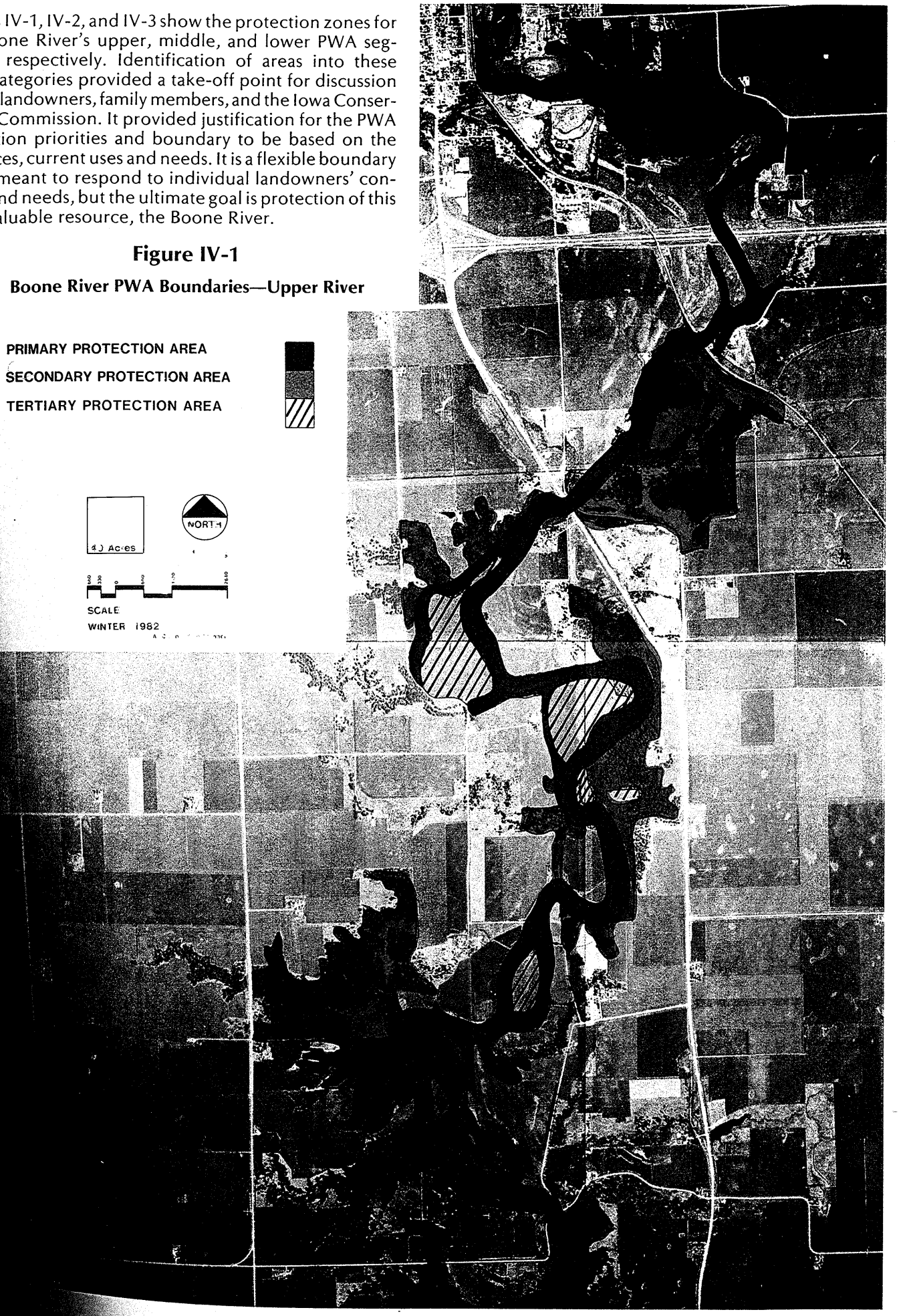
   b. Forests and savannas on the uplands that are further back from the river, unable to be seen from the river but still play a major role in the healthy and diverse ecosystem along the river.

3. **Tertiary Protection Area -** These areas are typically in the floodplain surrounded by Primary Protection Areas. These areas have been cleared and are currently cropfields. They should never be changed to industrial, commercial, or residential uses. Home development will probably not be a threat to these areas since they are prone to periodic flooding. This area totals 625 acres, of which 539 acres are in private ownership and 86 acres are public land.

Figures IV-1, IV-2, and IV-3 show the protection zones for the Boone River's upper, middle, and lower PWA segments, respectively. Identification of areas into these three categories provided a take-off point for discussion among landowners, family members, and the Iowa Conservation Commission. It provided justification for the PWA protection priorities and boundary to be based on the resources, current uses and needs. It is a flexible boundary that is meant to respond to individual landowners' concerns and needs, but the ultimate goal is protection of this most valuable resource, the Boone River.

Figure IV-1

Boone River PWA Boundaries—Upper River



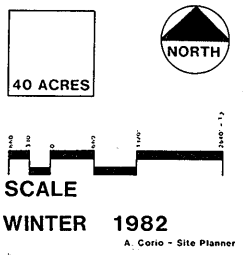
PRIMARY PROTECTION AREA

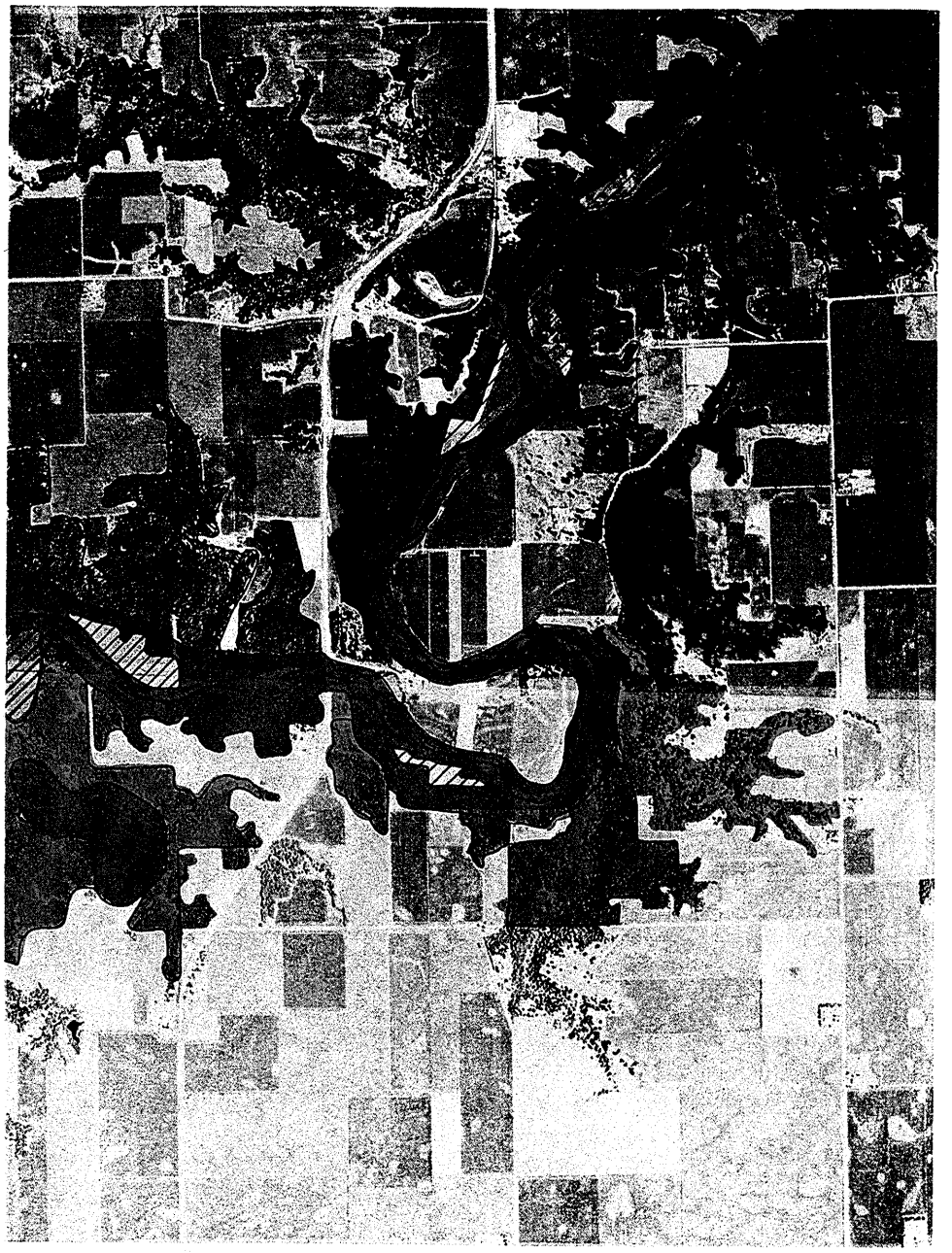
SECONDARY PROTECTION AREA

TERTIARY PROTECTION AREA

Figure IV-2

Boone River PWA Boundaries—Middle River





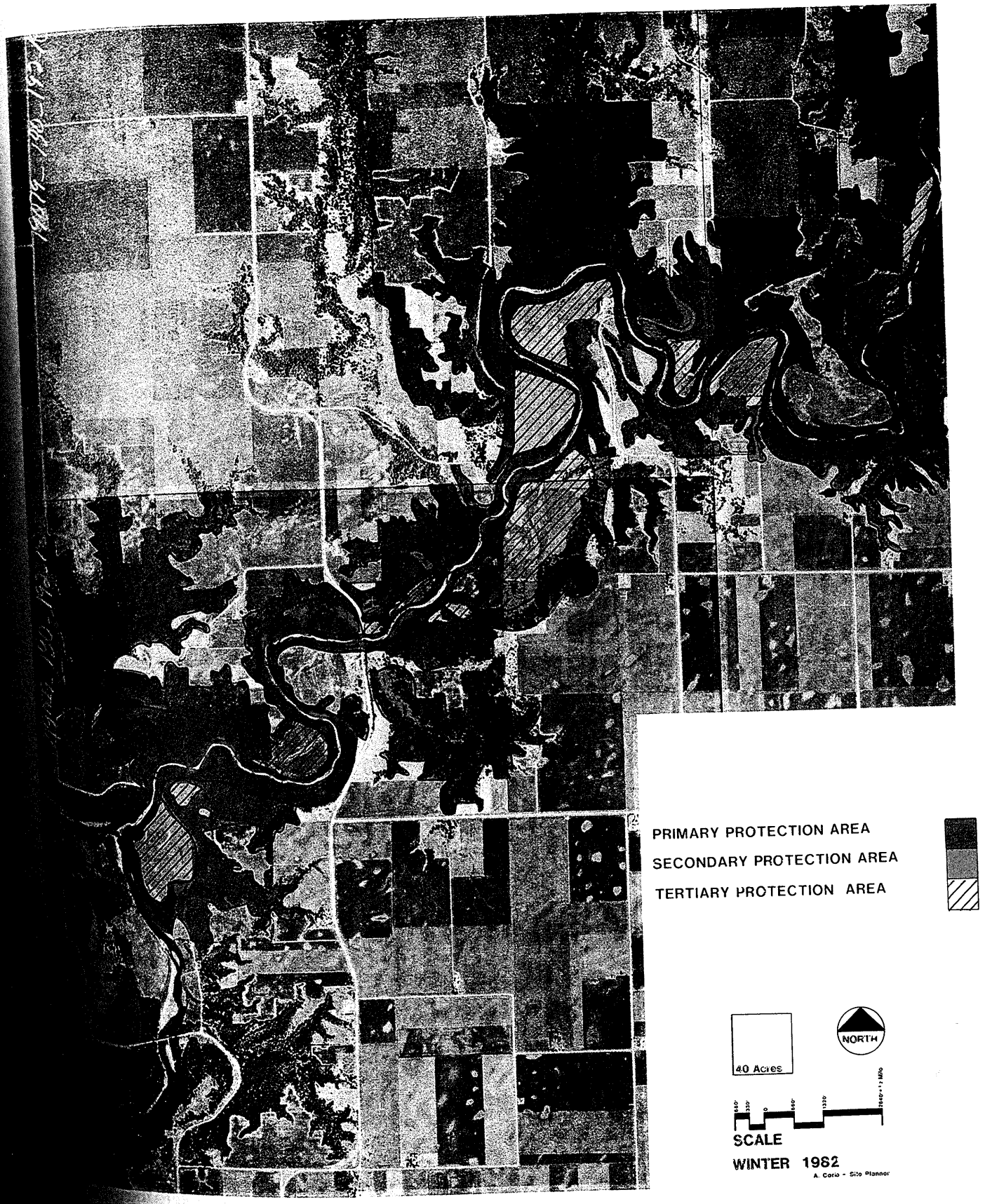
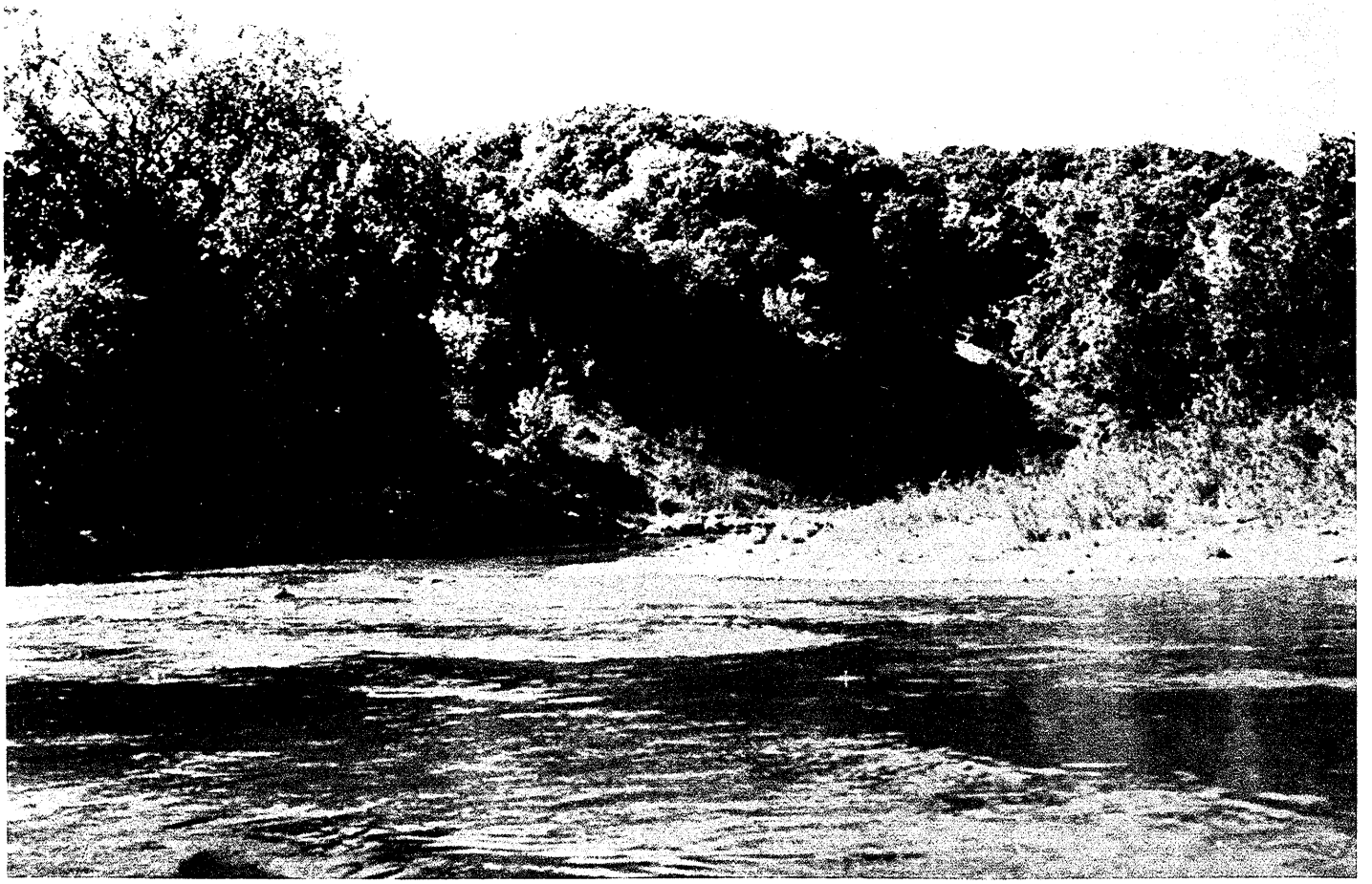


Figure IV-3

Boone River PWA Boundaries—Lower River



CHAPTER FIVE
PROTECTION METHODS

A variety of methods are available that can be used to protect the Boone River. They are in the form of land management agreements between landowners and the ICC. These methods include:

1. conservation easements;
2. leases;
3. tax credits;
4. state preserve dedications; and
5. land acquisitions.

Landowners will decide, depending on their personal interests and economic situation, whether or not they will need to be paid for the selected agreement.

The approach of the PWA program is to use whichever method or combination of methods best suits a particular situation. The method will be selected based upon the landowner's interest and personal situation, and upon the specific resources identified for protection. The agreements may include all the landowner's property or any portion thereof. The ICC will be emphasizing the establishment of agreements only on the portion of property within the designated "protected water area." They may also emphasize the use of certain protection methods that are most suited for resources that make up a particular protection zone.

Landowners will decide for themselves whether or not to participate in the program through one of the available methods. No one will be forced to participate, nor to use any particular method. The ICC will present all alternatives to each landowner and will help prepare the language in the agreement that is mutually selected. The landowner and ICC must both take care in selecting the method. The ICC urges those landowners who are interested in the PWA program to discuss it with their family, ICC staff, and, in some instances, their attorney. It is very important that everyone involved understand the conditions of the agreement and how they affect the landowner, as well as the Boone River.

The ICC realizes that some landowners will choose to not participate in the program. Some may agree with its purpose and manage their land accordingly, but they will not want to get involved in a formal agreement with the ICC. Other landowners will be opposed to the program's purpose and will choose to not participate. Consequently, gaps will occur in the river's protection, but the ICC currently feels they will not significantly jeopardize the river's long-term protection. Some gaps will undoubtedly be filled over time as existing landowners' interests or situations change, or as property changes hands.

he available protection methods are briefly described in he following sections. The reader is referred to the eferences listed below for more details:

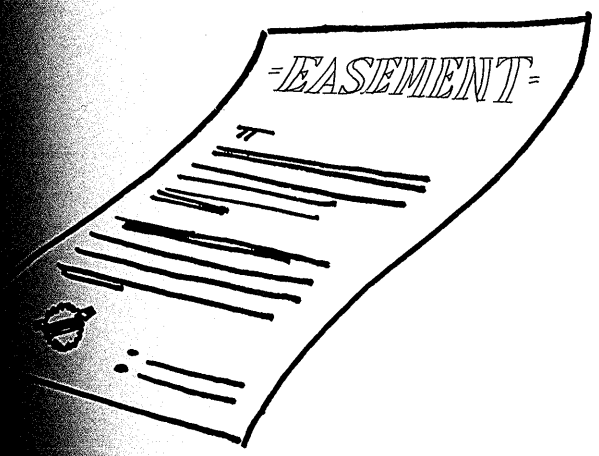
Iowa Protected Water Areas General Plan, March 1981, Chapter 3, Iowa Conservation Commission.

Alternatives to Fee Title Land Acquisition, 1978, Iowa Conservation Commission.

The Landowner Options, February 1982, Iowa Natural Heritage Foundation.

nservation Easements

easement is a legal document that transfers selected operty rights of the landowner to another person or ganization. It is attached to the property deed and is petual unless otherwise specified. The conditions of easement must also be adhered to by new landowners roperty changes hands. A conservation easement ludes those rights of a property owner that if exercised uld destroy the scenic and natural character of the d. Examples of such rights include developing heavy dustry or high density housing subdivisions, using the operty for a landfill, clear-cutting an area of trees hout an approved forestry plan, grazing timber, row pping steep or otherwise unsuitable land, and building mmercial structures such as motels, billboards, and es. In the case of the Boone River PWA, these types of ts would be transferred to the ICC so that existing or re property owners cannot exercise them. Subquently, the designated area would remain in its scenic dition since the ICC would be the long-term holder of selected rights and will not be interested in exercising ms. This type of ICC-landowner agreement will be most licable on the Primary Protection Zone of the PWA. ICC has the authority under Chapter 111D, Code of to purchase easements or receive them as gifts.



ation easements can also be written to clearly ertain rights that the landowner desires to keep. of these include the rights to cut firewood, build ce in an approved location, plant a garden, and orchard or walnut stand. Appendix E contains a plete listing of restricted and permitted uses be specified in a conservation easement. Exact an easement will be negotiated with each

ent can also specify whether or not the landees to allow public access on the property. The ICC will not emphasize public use of private property within the Boone River PWA, since the prograared towards resorce protection rather than providing public recreation areas.

Leases

Leases for preserving natural resources are very similar to conservation easements. The major difference is that leases are typically the acquisition of land rights from an owner for a specified time period and easements typically purchase these rights on a perpetual basis. At the end of a lease period, the agreement may be renewed, renegotiated, or discontinued. The lease expiration time is a convenient breaking point for both the lessor and lessee to assess the effectiveness and value of the lease.

The lease concept can be used in one of two ways. The first way is for the ICC to lease specific rights directly from the landowner. For example, the ICC may lease a landowner's right to use an area immediately adjacent to the river for crop production. The cost of this lease might typically be the profits the landowner would have received from the crop. By purchasing this lease, the ICC is assured that the landowner will not crop immediately adjacent to the river.

The second way the ICC can use leases is commonly referred to as "purchase and lease-back." This alternative involves the ICC purchasing a tract of land in fee title and then leasing a portion of its property rights back to the original landowner. For instance, the ICC may purchase a tract of land along the Boone River and lease back to the original landowner the right to maintain his or her home and continue to live on the site. The easement conditions in Appendix E may also be used in lease agreements.

Tax Credits

Tax credits are available in two basic forms as a Boone River protection method: 1) property tax breaks and 2) reduced income taxes. Landowners who maintain certain conservation areas on their property are eligible for reduced property taxes. In fact, landowners do not have to pay any taxes on the portion of their property that qualifies for the available tax break programs. This protection method may be most suited for the Secondary Protection Zone of the PWA since management on these areas can be more flexible than on the Primary Protection Zone.

Iowa's Fruit Tree and Forest Reservation Act, Chapter 161, Code of Iowa exempts landowners from having to pay taxes on certified woodlands and orchards. Landowners

who participate in this program agree to manage their fruit tree or forest reservation according to the specifications in the Act. Since most of the proposed Boone River PWA is woodlands, this tax credit program is an important protection method.

Iowa's Property Exempt and Taxable Act, Chapter 421.1(36), Code of Iowa exempts landowners from having to pay taxes on certified natural conservation or wildlife areas. These areas include wildlife habitat, native prairie, wetlands, open prairie, forest cover, rivers, streams, river and stream banks, and recreation lakes. Procedures and conditions required for the exemptions are specified in Chapter 421.1(36).

Landowners interested in receiving tax exemptions on their fruit tree or forest reservations and natural conservation or wildlife areas must submit an application to certain county or state officials. The areas must then be inspected and, if they qualify, certified by the designated official. Application deadlines, certifiers, and periods of certification are different for the various types of areas. Table V-1 includes this information for landowners of Hamilton County within the proposed Boone River PWA.

Tax credits leading to natural resource preservation may also be available through income taxes. In certain situations, it will be to a landowner's financial advantage to donate, rather than to sell, property or an easement to a public agency or nonprofit private organization. Also, a landowner who wishes to sell his or her property will, in some cases, owe less total income taxes if the sale is arranged so that payments are made over an extended time period (e.g. four years). An attorney who specializes in real estate and income taxes will be able to provide legal assistance to the land seller and/or buyer by analyzing the specific set of circumstances. Since no two situations will be the same, a separate attorney's opinion will be needed for each land sale or donation.

State Preserve Dedication

A state preserve is any area of land or water that is dedicated under the State Preserves Act, Chapter 111B, Code of Iowa. These areas are very special places in Iowa and their preservation is the best and most important use of that land. To qualify as a preserve, an area must have the potential to be maintained in its primeval character or have unusual flora, fauna, geological, archaeological, scenic, or historic features of scientific or educational value. These types of resources will typically be located within the Primary Protection Zone of the Boone River PWA.

Any public administrative agency or private owner may allocate an area for a state preserve. A preserve is formally dedicated upon recommendations by the State Preserves Board and final approval by the Governor. The articles of dedication are attached to the deed of title for the property and are transferred to any new landowner. The articles describe how the property shall be cared for, much like the conditions in a conservation easement.

State Preserve dedications and conservation easements can be jointly used in some situations to provide landowners with an appealing protection method. The preserve dedication will give the landowner deserving recognition by the Governor and other top officials in Iowa for committing to maintain the nativeness of their property. The conservation easement, if donated to the ICC, other public agency, or nonprofit private organi-

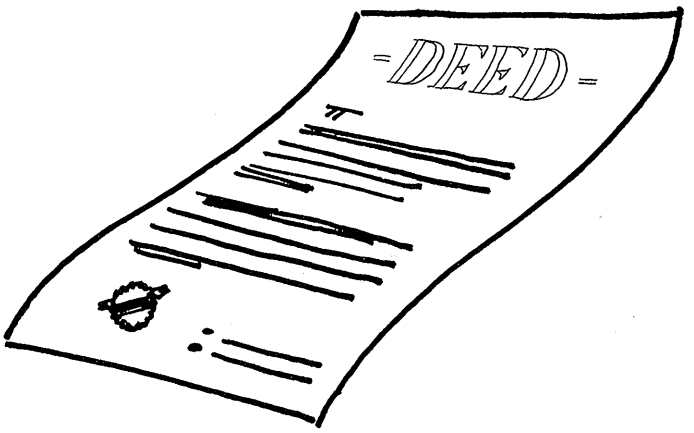
TABLE V-1
HAMILTON COUNTY'S CERTIFIERS AND APPLICATION DEADLINES FOR PROPERTY TAX EXEMPTIONS

Type of Area	Certifier	Application Deadline	Period of Certification
Forest and Fruit Tree Reservation (2-acre minimum)	Hamilton County Cons. Board Rural Route 1 Webster City, Iowa 50595 Phone 515/832-1994	Application must be submitted to certifier by April 1	Until decertified
Wildlife Habitat (2-acre maximum)	Wildlife Management Biologist Iowa Conservation Commission Boone County ASCS Office Boone, Iowa 50036 Phone 515/432-4320	Application should be submitted to certifier by April 1	Until decertified
Native Prairie (no size limitation)	Hamilton County Cons. Board Rural Route 1 Webster City, Iowa 50595 Phone 515/832-1994	Application should be submitted to certifier by January 15	Until decertified, but new application must be submitted every year
Wetlands Open Prairie Forest Cover Rivers and Streams River and Stream Banks Recreation Lakes (2-acre minimum)	Soil Conservation Service 1921 Superior Street Webster City, Iowa 50595 Phone 515/832-2916	Application must be submitted to certifier by April 15	3 years for wetlands 1 year for all the other types of areas

zation, can result in reduced income and property taxes paid by the landowner.

Land Acquisitions

The ICC can acquire land from willing sellers within the Boone River PWA provided funds are available. The PWA Act prohibits them from using eminent domain to acquire property for the PWA program. Property can be acquired by the ICC through land sales, bargain sales, and donations. Landowners interested in selling their property to the ICC will need to thoroughly review these options with respect to their economic and personal situations. In certain situations, it will be to a landowner's financial advantage to donate property to a public agency or other nonprofit organization rather than to sell it.



The ICC will prefer in some instances to acquire property in fee-title ownership, rather than using one of the other available protection methods. Examples of these properties are public access sites to the river, conveniently located public resting areas for river users, and land in the Boone Forks Wildlife Acquisition project. The ICC may also need to acquire lands that have extremely sensitive resources such as endangered plants or animals and fragile geological features in the Primary Protection Zone.

PWA Registry Program

Landowners who participate in the Boone River PWA project will receive a certificate from the ICC. This includes landowners who establish a protection agreement with the ICC and those landowners currently not interested in entering into a formal agreement, but are sincere about taking care of their property in a manner consistent with the PWA program.

The certificate will express the ICC's appreciation and register the recipient as a PWA participant. The ICC Chairman and Director will sign the certificates and the Director will present them to the landowners at a PWA registry ceremony. The registrations will give landowners the recognition they deserve and help establish a good relationship between them and the ICC. The landowner may be willing to give the ICC first chance to buy the property if he or she decides to sell in the future. This arrangement can be established in writing if agreed to by both parties.

CHAPTER SIX
PUBLIC/LANDOWNER PARTICIPATION

The ICC has learned over the years that local public and landowner input throughout the planning process is vital in developing a successful program. This is particularly true for a project like the Boone River PWA since landowners and local officials will continue to be involved during its implementation. A variety of public involvement methods were used to disseminate and receive information while preparing this management plan. These methods include newsletters, public meetings, individual contacts with landowners, and small group sessions with landowners. The ICC sincerely feels they have developed a workable approach to Boone River protection by actively listening to many concerned people and incorporating their thoughts in this plan.

Newsletters

The ICC distributed four newsletters during the course of preparing the Boone River PWA Management Plan. They were mailed to the following people:

—landowners in the study area
—local legislators
—Hamilton County Board of Supervisors
—Hamilton County Conservation Board
—Soil Conservation District Commissioners
—Hamilton County Assessor and Auditor
—Webster City officials

The purpose of the newsletters was to inform interested people living and working in the area about the study's progress. Meeting announcements, study element summaries, and upcoming project activities were in them.

Group Meetings

The ICC conducted three types of group meetings during the Boone River PWA study. They were: 1) a comprehensive presentation of the study to selected key individuals; 2) small group sessions with landowners in the study area; and 3) public meetings. The following sections summarize the purpose and attendees of these meetings and the topics discussed during them.

Presentation to Key Individuals — The ICC called together selected key individuals early in the Boone River PWA study to explain the program and the planning process the ICC will use to prepare the management plan. This meeting also allowed the people to provide the ICC with their ideas and concerns which should be addressed in the plan. The people invited to the meeting included various local public officials and a few landowners along the Boone River who are interested in conservation programs or are frequently involved in community matters. The ICC anticipated that landowners, upon hearing about the PWA project, would probably first contact one of these key individuals to see what they

know about it. Having attended the meeting, these individuals would be able to accurately answer questions by the landowners and discuss issues with them.

The meeting of key individuals was held on January 25, 1983, and was attended by about 25 people. They had very little response during the formal meeting, but individual discussions afterwards revealed that most saw a need for the program and liked the ICC's approach. The Hamilton County Conservation Board voiced their support for the project to the ICC and the key individuals at the meeting. People did leave the meeting fully informed and equipped to discuss the project with inquisitive landowners.

Small Group Sessions with Landowners — The ICC met with small groups of landowners to explain the Boone River PWA project and listen to their initial concerns and ideas. All landowners in the study area were mailed an invitation to attend any one of nine sessions held over a three-day period. Specific times for these sessions were at 10:00 a.m., 2:00 p.m., and 7:00 p.m. on March 1, 2, and 3, 1983. Thirty-two landowners attended the sessions, which was a little over 25 percent of the landowners in the study area. Group size of the sessions ranged from two to seven landowners. A newsletter that summarized the information presented at the sessions was mailed to all landowners, so everyone received an introduction to the project.

The following is a summary of the comments received from the 32 landowners who attended the sessions:

—Eleven of the 32 owners indicated they support or agree with the program.

—Two landowners said they will not participate in the program.

—Two people commented that canoeists have caused them problems in the past and were concerned that PWA designation would cause an increase in conflicts.

—A few landowners wanted to make sure they could continue cutting firewood.

—Two people were concerned with how their participation in the PWA program would impact their property value and resale attractiveness.

—One person inquired whether or not the program will solve river bank erosion into adjacent farmland.

—Seven of the 32 landowners listened to the presentation, but did not make any comments nor ask questions.

Public Meetings — The ICC held two public meetings during the Boone River PWA study. These were held during the evenings of July 27, 1983, and March 26, 1985. Meeting announcements were provided to local newspapers and radio stations. Landowners in the study area and the local key individuals received letters announcing the meetings.

The primary purpose of the July 27, 1983, meeting was to present the resources inventory and assessment of the Boone River valley. The information was placed on large maps and meeting attendees had an opportunity to see what resources are located on particular land tracts. The individual landowner contact process and schedule was also described at this meeting. About 20 people attended and 10 were landowners in the study area. Other people in attendance were local public officials and interested citizens. Everyone at the meeting was congenial and seemed to appreciate being informed on the study's progress and schedule of future activities.

The primary purpose of the March 26, 1985, public meeting was to: 1) summarize the contents, conclusions, and recommendations in the draft management plan; and 2) receive comments on the plan from landowners and other interested people. Copies of the draft plan were made available for public review and the Hamilton CCB office during the week before the meeting and at the meeting place two hours prior to its formal commencement. Several people did look at the plan during these preview opportunities.

Approximately 60 people attended the meeting. They asked questions on several topics, including easements, oil exploration leases, mineral rights, water quality, condemnation, land acquisition, and landowner liability. These topics are addressed in the management plan and people at the meeting seemed to be comfortable with the answers to their questions. The following is a summary of the individual comments presented at the March 26 meeting:

—I favor acquisition for recreational purposes that are only absolutely necessary; otherwise I prefer easements and leases so the land stays in private ownership. If the ICC comes in and buys up all the natural areas, it would be sort of like a corporate land grab and these types of areas will not be available for future generations to purchase.

—I am an interested citizen who has canoed the Boone River. I want to express my gratitude to the landowners who are cooperative with this program and for taking such good care of the river. From the perspective of a citizen who does not own land along it, the river is a special place, not just for the water, but also for the lush vegetation, landforms, and wildlife. This is not an expensive program and it will be a very worthy expense. I hope it will be implemented on the Boone River and be expanded to other worthy rivers in the state.

—I look at those things that provide tourist attractions and economic benefit. This project might have economic benefits for Hamilton County since the Boone River does attract people from outside our area who spend money during their visits at our businesses.

—I am a landowner in the secondary protection zone. I have canoed this river for years and I wholeheartedly support this project. It is flexible enough to allow participation by many landowners with varied interest.

—My wife and I own the most beautiful area along the river. We totally support this project to protect the Boone River. Our bank is too high and steep to ever be bothered by the canoeists, but we hear them enjoying themselves.

—My family owns land in the Tunnel Mill area. We support this project because we are much in favor of seeing this land stay as it is, no matter who owns it. The program is also flexible enough to harvest timber.

—The county conservation board is the primary natural resource manager in the county. One of my first projects was to look at the Boone River corridor. It is such an attractive area, but we knew that our county

agency would not have the money to handle such a large, complex project. It is important to have the state involved, because of the river's statewide significance. The Hamilton CCB has supported this project for years and will continue to do so.

—I have seen more and more people using the river on my section. After the designation, people will feel that they have more access to it. I have high bluffs next to the river and have been told that I am responsible for what people visiting the river do. If a landowner participates in the program or not, who will be responsible should a canoeist get injured on private property? I hope there will be some education with this program for canoeists to learn what is private property and what is public land. We bought this land for my family's recreation. I have taken care of my responsibilities and I wish recreationists would take responsibility for themselves. Ninetynine percent of the recreationists are perfect, but the one percent of bad ones can ruin your good feelings. Most landowners want to work with them, but you need to inspire recreationists to work with landowners.

—I like the idea of another access and parking lot to allow people to get to the river.

Individual Landowner Contacts

ICC staff met individually or in small groups with landowners in the study area to discuss how the proposed Boone River PWA designation relates specifically to their property. These landowner visits mostly took place during October, 1983 to February, 1984. A few contacts were made in May, 1984 with landowners who spent the winter months in the south.

The ICC presented a booklet to each landowner during the meeting, which was theirs to keep. The booklet contains: 1) a summary of the PWA program and approach; 2) a general description of the resources in the Boone River valley; 3) maps of the landowner's property with resouce information displayed on them; and 4) a second smaller booklet entitled "The Landowner Options" that introduces available ways landowners can participate in the PWA program. "The Landowner Options" booklet was prepared in February, 1982 by the Iowa Natural Heritage Foundation for statewide use.

Eighty-four (84) of the 102 landowners in the Boone River PWA study area were personally visited and presented the booklets. The remaining 18 owners either lived out of town or a meeting time could not be arranged with them. Booklets were mailed to these people, along with a letter explaining why we could not personally visit them. A preaddressed and postage-paid card was provided for them to return any questions or comments to the ICC. Only a few landowners returned the postcards.

The contents of the booklets were briefly summarized during the 84 personal visits with landowners. The presentation was informal and induced two-way conversation with the landowners. Many landowners voiced their support or opposition of the project, but most wanted additional time to think about it. Table VI-1 summarizes the landowners' initial reaction to the Boone River PWA project.

Table VI-1
Landowners' Reactions to the PWA Program during the First Personal Visit with ICC Staff

Reaction	Number of Landowners Visited	Percent of Landowners Visited
Supportive	36	43
Opposed	8	9
No indication, but inquisitive	26	31
No indication and noninquisitive	14	17
TOTAL	84	100

The ICC encouraged all landowners to thoroughly read the booklets and discuss the program with their family. The ICC explained the importance of landowner responses being sincere and honest so an assessment of the program's likelihood for success could be accurately accomplished. The landowners were informed at the end of the visit that they will be recontacted by the ICC in about six months and asked what their existing position is on the Boone River PWA project.

The resource assessment (see Chapters 2 and 4) revealed that the proposed Boone River PWA should be less than the original study area. Eleven (11) of the 102 landowners are outside the proposed protected area. These people were contacted and the resource assessment explained to them, with emphasis placed on why their property has been excluded from the proposed PWA. All landowners agreed with the assessment results.

The 91 landowners were telephoned during September and October, 1984. They were specifically asked the following questions:

1. Do you support the Boone River Protected Water Area project?
2. Will you be interested in developing and establishing one of the available protection agreements with the ICC?
3. Which agreement are you most interested in for helping protect the Boone River for years to come?

Tables VI-2 and VI-3 summarize the landowner responses during the telephone conversations.

Table VI-2 shows that 43 landowners are willing to negotiate some type of PWA agreement with the ICC. Some of them have a good idea which agreement and whether or not they will need to be paid for it, and others are not sure at this time (see Table VI-3). They are all rightfully interested in seeing the specific conditions before they ultimately decide whether or not to participate in the program.

In closing, the landowner contact phase of the Boone River PWA project took a lot of staff time. The information obtained was plentiful, and the process established a good rapport and working relationship between the ICC and many landowners. The ongoing success of the Boone River PWA project will depend on the maintenance of this relationship.

Table VI-2
Landowners' Reaction to the Boone River PWA Proposal during the Follow-Up Telephone Conversation

Reaction	Number of Landowners Phoned	Percent of Landowners Phoned
Supportive and willing to negotiate	37	41
Supportive, but not willing to negotiate	17	18
Neutral and not willing to negotiate	13	14
Opposed to project	10	11
Neutral, but willing to sell property	6	7
Unable to contact	8	9
TOTAL	91	100

Table VI-3
Type of PWA Agreement that Interests Those Landowners Currently Willing to Negotiate

Type of Agreement	Number of Landowners	Percent of Landowners
Sell property	9	21
Donate easement	7	16
Sell lease	1	2
Donate lease	4	10
Property tax incentive*	1	2
Undetermined, but will not require compensation	3	7
Undetermined, but will require compensation	5	12
Undetermined and do not know if compensation will be required	13	30
TOTAL	43	100

*NOTE: Twenty-one (21) landowners and 1,070 acres within the proposed PWA are currently in the Forest Reservation tax incentive program.

CHAPTER SEVEN

RESOURCES MANAGEMENT GUIDELINES

The basic management principle for the Boone River PWA is that different land uses can coexist along the river. Timber harvesting, firewood cutting, recreation activities, residential housing, and row crop production will all be able to take place in the Boone River valley. The key will be to locate and manage these land uses in a manner which will have minimal impact on one another, and on natural and scenic characteristics of the area.

Boone River PWA management will be accomplished through the joint efforts of private and public landowners in the project area, and through associated resource management programs administered by government agencies. The ICC will prepare a brochure that summarizes management guidelines and identifies people available for providing management assistance. The brochures will be distributed to landowners along the Boone River. All individuals and entities involved in the project should refer to the management guidelines in the brochure and this chapter. Everyone should communicate with one another to assure conflicts are alleviated, or at least minimized. The management recommendations are purposely referred to as guidelines since they must be adapted to specific situations in recognition of other nearby land uses.

Woodlands

Historically, little timber management has been practiced on woodlands in the Boone River PWA. Central Iowa is too far removed from markets to make timber in this area very profitable in a commercial sense. Walnut trees have been periodically harvested from river bottom areas, and limited log and fuelwood harvesting has taken place throughout the area.

The oil shortage of 1973 and increasing cost of fossil fuel has renewed interest in fuelwood production — nationwide, as well as in the Boone River PWA. Fossil fuel price increases have been the catalyst causing many people in the area to again use wood as a fuel to heat their homes. Fuelwood harvesting at the present time constitutes the single largest use of forest products from the area. Potential for increasing fuelwood consumption in the area is considerable. Recent improvements allow wood and woodchips to be burned for drying grain crops, and many homes, businesses and industries can by heated with wood grown in the Boone River valley.

Managing forest stands along the Boone River for fuelwood is one of the best management practices we have available. Many of our stands contain low value, poor quality hardwoods that have little value on the hardwood

lumber market; but these same stands can be well utilized for fuelwood. By harvesting fuelwood from these stands, the poor quality, poorly formed, diseased or damaged trees are removed and the better formed, higher quality trees are left for more growth and future harvest. Some low quality trees should, however, be left for wildlife benefits, since they do provide den and nesting sites for several species. Alternatively, we can make clear cuts to completely open up stands and get the types of regeneration that will result in quality stands in the future. In summary, fuelwood harvest allows for income from the forest while making timberstand improvements.

Many woodlands will transform from oak-hickory stands of today to hard maplebasswood stands in the future if we do nothing to the forest stands now on the area. Hard maple and basswood are shade tolerant, so their seedlings can grow under the shade of other trees. Complete transition from oak-hickory to maple-basswood can have a very dramatic effect on forest wildlife that depend on oak and hickory seed for food. A very important food source for many forest wildlife species may be lost. However, some maple-basswood stands should be allowed to develop since they often provide the best den trees for wildlife. In other words, both stand types are needed to achieve balanced management for woodland and wildlife benefits.

If we wish to maintain the oak and hickory stands on an area, the stands must be opened up enough to allow full sunlight to reach the forest floor. In a practical sense, this means small clear cuts are needed to regenerate oak. These clear cuts will not only help to regenerate mast-producing trees, but they will also initially increase stem density and cover for many wildlife species, and increase the edge effect in the forest.

Landowners in the Boone River PWA have a district forester at Humboldt to help manage forestlands. A forestry technician associated with the Hamilton County Conservation Board is also available. Both can advise landowners on proper forest management practices and on planting new forest areas.

The Tree Farm Program recognizes landowners doing a good forest management job and provides an incentive to practice forest management.

The Forest Reserve Law provides that landowners who meet requirements of the law need pay no property tax on their forestland. The main requirement is protection from grazing. Several other incentives are available which apply to specific circumstances. Information about them can be obtained from the district forester.

Wildlife

The diversity of participants in the Boone River PWA and the degree to which each individual may participate in the project precludes the development of a specific wildlife management plan. However, the underlying wildlife management goal should be to enhance the timber resources through protection from fire and grazing. Grazing the forest by domestic livestock should be eliminated to allow for tree regeneration, promote understory development, reduce soil compaction, and limit soil erosion. Domestic livestock kill more trees in Iowa each year by grazing than those that die from all other causes combined. Forest clearing for pastures and agricultural crops should also be discouraged with a concurrent emphasis on reforestation of suitable areas.

Timber management aimed at promoting the oak-hickory association and maintaining it in different successional stages in close proximity by small clear cuts will benefit most forest wildlife. Even-aged timber harvest should be employed in small scattered patches (two to ten acres) which comprise 15 to 25 percent of the timber unit to promote rapid growth of forbs, grasses, and woody browse, and to create successional diversity. Clear-cuts should be scheduled to provide the greatest interspersion of age classes. At least three to five den trees and snags per acre should be retained on the site of each cut. Slash from the cuts can be used to form brush piles for wildlife. In younger growth stands, future cavity trees can be created by pruning a three-inch diameter limb to six inches from the trunk. The establishment of field windbreaks and hedgerows will provide forest wildlife with rest sites and travel lanes. Hedgerows and other shrub-small tree layer plantings should include plant species which are of high food value to wildlife, such as serviceberry (Amelanchier spp.); dogwood (Cornus spp.); viburnums, cherries, and plums (Prunus spp.). Additionally, understory growth such as Virginia creeper, grape, and raspberry should be encouraged. Corn should be planted where suitable within forest units in three- to five-acre plots to provide an adequate winter food supply during periods of extended snow cover. Reseeding and renovation of abandoned pastures produces a good supply of forbs and grasses which are used by forest wildlife as loafing, feeding, and nesting areas. Landowners can obtain assistance in wildlife management from the ICC's wildlife biologist officed in Boone, Iowa.

Fisheries

The Boone River, between Webster City and its confluence with the Des Moines River, supports a diverse fish community. The major sport fish are selfsustaining populations of smallmouth bass and channel catfish. These species are dependent upon the high quality of habitat which is found in this river reach. Because these fish are not maintained through maintenance stocking programs, the protection of existing habitat is essential to ensure healthy populations in future years. This goal is being accomplished by protecting the river corridor and maintaining the natural character of the area through PWA designation and management.

Fish populations should be monitored on a biennial schedule. Age, growth, recruitment, and relative abundance will be evaluated for the major sport fish. Regulations involving number of take and size limits will be implemented if deemed necessary to improve the quality of the sport fishery.

Construction of fishing riffles and/or stream jetties are possible habitat enhancement programs on the Boone River. Consideration must be given to the impact these structures would have on the hydrology of the river prior to installation. Because riffles extend across the entire stream width and require a three- to four-foot head, riffle areas would conflict with canoeing interests and should probably be avoided. Stream jetties are more compatible to multiple use on the river and may provide improved fishing opportunities. Any habitat improvement structures should be located on public land to maximize use

and accessibility, or if on private land, public access should be negotiated.

Stream bank erosion is not a major problem on the Boone River; however, six problem areas exist between Webster City and the Boone Forks canoe access. Increased siltation can degrade water quality and habitat creating problems throughout the early life history of smallmouth bass and channel catfish. These areas could be stabilized with a variety of control methods, i.e., riprap, gabions, or jetty systems. Bank stabilization efforts would be useless without first establishing a buffer strip approximately 50 feet wide in these areas.

Unique Ecological Features

The woodland vole and showy lady's slipper orchid are currently afforded some protection since they are on public land managed for forestry and wildlife. They could, however, also occur on private property. Undisturbed woodland is their main habitat requirement. The orchid is usually found on north- and east-facing slopes.

The colony of eastern mound-building ants is located on private property which is currently grazed by cattle. Physical disturbances by cattle, horses, and vehicles is detrimental to the colony. Cattle do, however, provide a necessary vegetative management function. The mounds must have total solar access. Shrubby vegetation and invader trees which would shade the mounds would cause the colony to die, according to a report to the Iowa Academy of Science in 1970.

More special plants and animals probably occur along the Boone River. Chapter 109A, Code of Iowa (Management and Protection of Endangered Plants and Wildlife) prohibits a person from taking, possessing, and transporting threatened and endangered species of fish, plants, and wildlife Individuals finding these species should not disturb them and promptly contact Iowa Conservation Commission staff for verification.

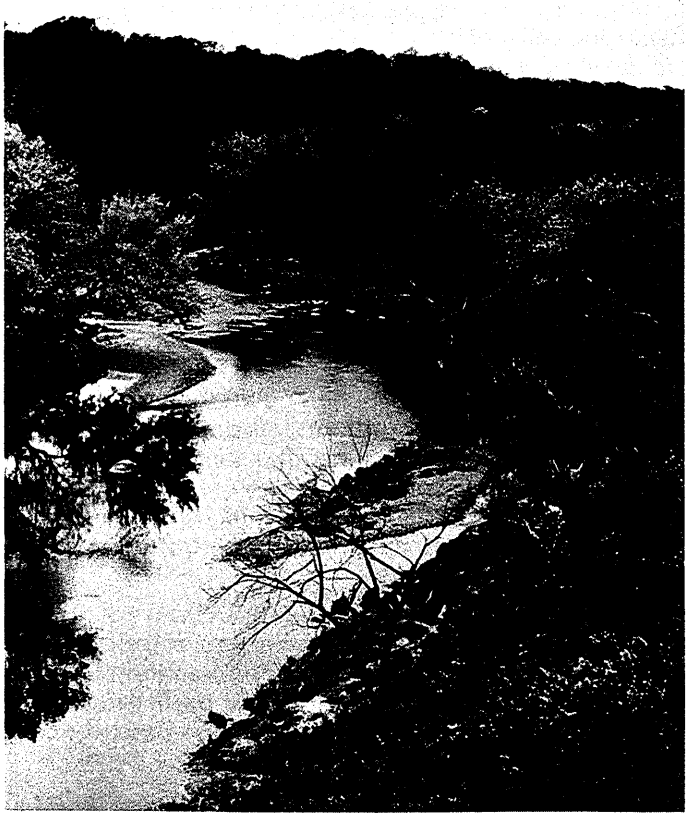
Recreation Use and Facilities

The PWA program will enhance and maintain outdoor recreation resources of the Boone River. However, recreation is considered a by-product of PWA designation and not the primary purpose. Remember, the primary purpose of the PWA program is to maintain the area's natural and cultural resources. Recreation use and facilities must also be consistent with the goals of the PWA program.

Boone River PWA designation will not open private property for public access and recreation. Whether or not the public will be allowed on a certain piece of property will be left up to the private landowner, and his or her decision will be specified in the PWA agreements with the ICC. It is important that landowners maintain control over who uses their property and how it is used.

Some landowners have expressed concern that increased recreational use of the Boone River after PWA designation would make it more likely that a hiker would try to hold a landowner liable for injuries in a hiking accident. PWA designation would not alter the legal relationship between a person who enters on land and the owner of the land.

Landowners have been given additional protection from liability by a chapter that the legislature added to the Iowa Code to encourage landowners to allow public recreational use of private lands. Chapter 111C (1985) specifies that a landowner owes no duty of care to keep property safe for entry or use by others for recreational purposes, or to give warning of a dangerous condition, use, structure, or activity on such property to persons entering for recreational purposes. There are three exceptions that create a duty to warn or make the property safe for recreational use:



1. When the landowner charges a fee for recreational use of the property;
2. When the landowner willfully or maliciously fails to guard or warn against a dangerous condition, use, structure, or activity;
3. When the property contains a hazard that would be an attractive nuisance to children.

Landowners who do not want uninvited recreational users on their property may wish to post "no trespass" warnings. Landowners concerned only about potential liability for injuries to recreational users may request the assistance of the ICC in posting appropriate warnings where rough terrain or other factors make certain recreation activities hazardous.

The public does have the right to navigate the Boone River in accordance with Chapter 106.69, Code of Iowa. This law is relatively new (passed in 1982) and is intended to resolve potential conflicts between landowners constructing livestock fences or other barriers across rivers and recreationists navigating those rivers. Landowners required to contain livestock by fencing across the river

must recognize that the public has the right to navigate rivers. Landowners can either design fences across rivers to allow vessel passage or allow boaters to portage around the fence. Canoeists and boaters have the responsibility to recognize the landowner's requirement and properly use the passage structures through the fence or portage rights around it without abusing the law's intent. This law will be to everyone's benefit if landowners and recreationists share the responsibility of implementing it. The Boone River currently does not have any fences across it within the PWA segment.

Hiking, canoeing, cross-country skiing, hunting, fishing, trapping, and primitive camping are recreational activities which with few exceptions will be compatible with the PWA designation. This compatibility is, of course, contingent upon the activities occurring on public land and waters, or on property to which the recreationist gains access by permission of the private landowner. Modern camping and motorized recreation such as speedboating, snowmobiling, and motorcycling are examples of activities having greater possibility to be inconsistent with the program, especially when they take place on environmentally sensitas. These activities will require close monitoring and appropriate management action taken to assure continued resource protection.

Canoeing and fishing are the most popular summertime recreation activities on the Boone River. Public access to the river is currently good, with six sites located within the PWA. Accesses are spaced fairly evenly, with six miles being the greatest distance between areas. Some access sites could be improved to better accommodate canoe and small boat launching.

Visitors of the Boone River PWA must be responsible recreationists and respect other visitors, landowners, private and public property, and natural and cultural resources. Good user ethics will be mandatory for a successful PWA program in Iowa.

A public education/relations program should be implemented on the Boone River, particularly if the popularity of canoeing is maintained or continues to increase. This program will be designed to assure that canoeists and other recreationists respect the river's resources and the rights of adjacent private landowners. Issues such as littering, trespassing, camping, and campfire building will be key elements of the program. Personal contacts, brohcures, newspaper articles, and radio programs are possible methods for getting information to recreationists. Specific information presented to river users can include:

1. Location of private and public lands;
2. Permitted activities on these properties;
3. Description of river resources and their sensitivity level;
4. Water safety;
5. Boating and canoeing skills;
6. Overall good river use etiquette; and
7. Interpretation of natural features.

Conflicts between landowners and river recreationists will be minimized through a public education program which presents the above information.

Cultural Resources

Cultural resources of the Boone River are classified as historic and prehistoric. The historic time period begins with written record and the prehistoric time period existed before written record.

The Boone River is rich in historic resources because of its attractiveness for providing subsistence for early settlers. Records indicate that seventeen mills were once located on the river, but there is little or no physical evidence remaining. Several cemeteries occur near the river which contain graves of many early pioneers. Recommendation for management of all these areas is to maintain them in their existing state.

Prehistoric cultural resources include native American habitation and burial sites, some of which have been studied, primarily near the Des Moines River. Numerous unstudied sites, however, do exist. The Iowa State Historical Department's Office of Historic Preservation requests that if an item or items which might be of archaeological, historic, or architectural interest comes to light in the area, their office be notified in order that their significance can be determined. Archaeological sites should not be destroyed or looted, but protected and preserved. Indian burial sites are protected by state law (Chapter 305A, Code of Iowa). The Office of the State Archaeologist should be contacted immediately if human remains are found.

Preservation is multi-faceted and can be accomplished in many different ways. Preserving local history can enrich the lives of residents and collectively provides a rich state heritage.

Water Quality

The National Clean Water Act of 1977 established a goal that all waters in the nation shall be fishable and swimmable by 1988. This goal is the general guide to water quality management on the Boone River PWA. The Boone River is currently fishable and swimmable, so the management program will be to maintain or improve the existing water quality.

Webster City's and Eagle Grove's sewage treatment plants are designed to exceed the minimum requirements of the Clean Water Act and Iowa Department of Water, Air, and Waste Management recommendations. The plant must continue to be well operated accordingly to assure effluent discharges into the Boone River meet or exceed state and federal requirements. Existing wastewater treatment facilities of smaller cities discharging in the Boone River and its tributaries, through proper operations, are also in compliance with water quality regulations.

Other contaminant sources for the Boone River water are storm sewers, agricultural land runoff, and stream bank erosion. These sources often contain harmful pollutants (chemicals) and sediment. The origination point of these contaminants is difficult to locate and monitor, so overall wise watershed management is a good PWA guideline. Maintaining the valley's woodlands and vegetated buffers between cropfields and the river will reduce or filter these water pollutants.

Water withdrawals from the river can also affect water quality by decreasing the dilution factor. To date, this effect is incidental in the Boone River since only a few withdrawals are permitted. The number of permits and associated amount of withdrawals must be closely monitored to assure protected flows are maintained and minimum water quality standards are not exceeded.

Agricultural Uses

Agriculture is the dominant land use and income for landowners having Boone River PWA property. Most PWA land is steep and unsuited for agricultural purposes, so much of the farming takes place outside the designated area. Sound conservation farming techniques are important on these fields since they are within the Boone River watershed. Examples of these farming practices are no tillage, minimum tillage, contour plowing, and terracing.

Some very fertile cropfields are located in the river bottoms. Landowners are urged to maintain a buffer strip of natural vegetation at least 50 feet wide between these cropfields and the river bank. This buffer strip will protect the fertile alluvial soils by helping stabilize the bank and reduce erosion. Recommendations for correcting existing intensive bank erosion are in the next section.

Livestock grazing in well-managed pastures is compatible with the PWA program. However, livestock grazing in woodlands is the most serious agricultural threat to the Boone River's scenic character. When the cattle market is profitable, many landowners graze livestock in their woodlands. This land use eliminates regeneration of woodlands, compacts soil, and induces soil erosion on steep slopes. All these impacts over a 75 to 100 year period cause a slow death of woodlands in return for low quality pasture.

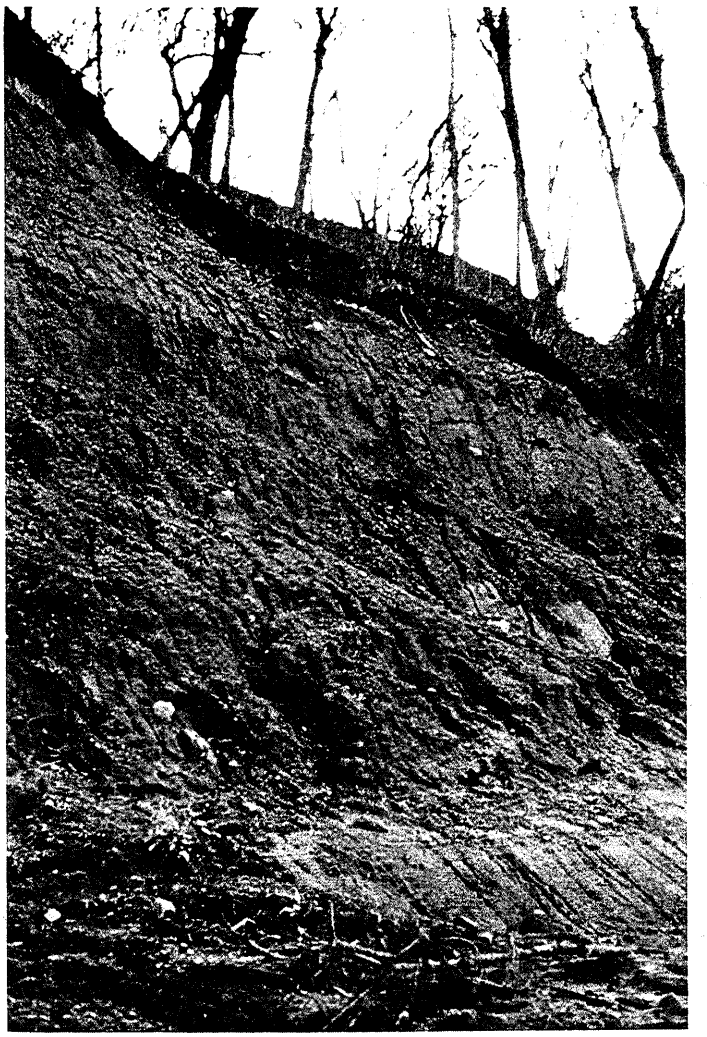
Landowners who release livestock into woodlands often mention that grazing controls brushy growth and allows them to easily walk through and enjoy the woods. This claim is valid since livestock browse the brush and young tree seedlings, but in doing so, they eliminate natural forest regeneration. Natural regeneration quickly occurs in woodlands when livestock no longer graze them. Dense thickets and brush soon cover the forest floor and provide good shelter for many wildlife species. Landowners wishing to enjoy these woodlands and the associated wildlife will want to maintain some walking paths by periodic mowing. Young trees will eventually emerge through the brush in the unmowed areas to maintain the woodland for years to come. However, the brushy stage of reforestation will last for at least 20 years, so we must all be patient. Appendix F presents more information on this subject in a bulletin entitled "Grazing Iowa's Woodlands" prepared by the Iowa State University Cooperative Extension Service.

Livestock feedlots are an agricultural land use that will conflict with the PWA program. Feedlots completely denude the landscape which subsequently destroy the area's natural and scenic character. They are also very susceptible to soil erosion, particularly when located on hillsides. The Iowa Department of Water, Air, and Waste Management administers regulations on feedlot operations. These regulations protect public health by prohibiting toxic runoff and solid waste from filtering onto the properties of others and into the state's waters. Feedlot operators are reluctant to locate adjacent to rivers since very costly control structures would be required to meet regulations.

No feedlots are currently located in the Boone River PWA. Current regulations may be sufficient to deter landowners from locating feedlots there in the future. As an added precaution, PWA agreements should prohibit feedlot operations.

Bank Erosion

As indicated in the fisheries section of this chapter, stream bank erosion is not a major problem on the Boone River. Six problem areas do exist, however, and all but one are associated with row crops immediately adjacent to the river bank. The exception includes the stream cutting its way across an unwooded field to an abandoned channel once occupied by the river. All the erosion areas are characteristically vertical, deep-cut banks on the outside bend of the river with no protection to guard against strong, erosive currents. The river can cut several feet into these unprotected areas each year, while at the same time building new land across the river at its inside bend. This process reduces adjacent cropfields and adds sediment into the river's water.



Natural deterrents to stream bank erosion are surface bedrock and deep-rooted vegetation. The erosional forces in the Boone River's problem areas were once slowed down by brush and tree roots, but this vegetation has been removed and not allowed to regenerate in order to produce row crops on the land. Hence, the river's natural erosion process has been allowed to rapidly progress, and it will continue to do so until it reaches a protected bank.

Several methods are available to help control erosion into these areas. Most of them include: 1) shaping the river bank (which means sacrificing some adjacent crop ground); 2) installing bank armor material (riprap or gabions); and 3) planting vegetation or allowing it to naturally

regenerate along the river bank. The bank armour will help stabilize the bank while the vegetation is getting established. Bank stabilization efforts will be useless without establishing and maintaining a buffer strip of vegetation at least 50 feet wide. This can only be accomplished by eliminating tillage on the buffer area.

Landowners are required to obtain a permit from the Iowa Department of Water, Air, and Waste Management for shaping and placing structures on eroded banks. Financial assistance is currently not available to landowners for preventing river bank erosion. The Iowa Department of Soil Conservation, U.S. Soil Conservation Service (SCS), and U.S. Agricultural Stabilization and Conservation Service (ASCS) all place a much higher priority on preventing sheet and gully erosion on cropfields, since these processes contribute a much higher percentage of soil loss in Iowa than does bank erosion. These agencies will provide technical assistance to landowners to help determine appropriate and effective methods for controlling a bank erosion problem.

Residential Developments

Single-family residences can be located within the Boone River PWA. New houses and buildings associated with it (garages, sheds, barns, etc.) must be located and designed in a manner consistent with the program's goals. The following are general guidelines for single-family residences in the Boone River PWA:

1. Lots platted or created by a metes and bounds description be a minimum of 10 acres in area and at least 250 feet at the building line and at the river bank.
2. All houses and buildings be located outside the Primary Protection Area (see Figures IV-1, VI-2, and IV-3 in Chapter 4), or designed and screened with native vegetation in a manner that minimizes adverse visual impacts from the river.
3. Structures not be located on slopes greater than 13 percent, unless their design does not induce soil erosion.

These guidelines, if mutually agreed upon, will be specified in the protection agreements between the ICC and landowners.

Multiple-family residences such as apartments, townhouses, condominiums, and trailer parks should not be located within the Boone River PWA. These high density housing developments are inconsistent with the program since they dramatically take away the area's natural character.

All landowners, occupants, and users of the Boone River PWA will continue to be responsible for complying with all federal, state, and local health and safety regulations. For example, existing and any new homeowners will need to comply with the rules and regulations of the Department of Water, Air, and Waste Management relating to the design and placement of sewage waste treatment facilities and any other water, air, and noise pollution controls. In accordance with Chapters 111 and 455B in the Code of Iowa, landowners will also continue to need a permit from the Iowa Conservation Commission and Department of Water, Air, and Waste Management for any construction on a floodway or floodplain and for any changes in the course, current, and crosssection of public waters.

Commercial Uses

Retail, wholesale, and rental businesses attract significantly larger volumes of vehicular and pedestrian traffic than the noncommercial land uses. Consequently, these businesses may subject the area to severe soil compaction, vegetation losses, and increased runoff which in turn would take away from the Boone River's natural and scenic character. The ICC will discourage landowners from establishing commercial enterprises along the river and, when possible, include a clause in the ICC-landowner agreement which forbids the placement of retail, wholesale, and rental businesses.

Amusement parks and commercial campgrounds which cater to motor homes and trailers are also incompatible with the PWA program. Once again, these types of businesses characteristically have large concentrations of human activity and facilities which destroy the area's natural setting. The omission of commercial campgrounds and entertainment parks is consistent with the ICC's management guideline to not provide modern campgrounds on public lands within designated protected water areas.

Industrial Developments

Industrial land uses such as utility plants and factories must not be located along the Boone River. They are direct conflicts with the objectives of the PWA program. Utility rights-of-way such as transmission lines, natural gas pipelines, and water supply lines currently need to be approved by the Iowa Commerce Commission. As a part of the application process for utility rights-of-way, the Iowa Commerce Commission is required to conduct public hearings during which interested and affected people, organizations, and agencies have an opportunity to review and comment on the proposed route(s). The Iowa Conservation Commission often takes this opportunity to express their support or opposition towards the proposed right(s)-of-way, particularly when it involves their property or affects one of their programs. The ICC will oppose all new utility rights-of-way which cross the Boone River PWA if alternative routes are available adjacent to existing public facilities such as roads and utilities. Environmental and visual impacts will be minimized if new telephone, electrical, gas, and water supply lines are located along those which already exist.

Roads and Bridges

Public roads near the Boone River give people an opportunity to enjoy some of Iowa's scenic and natural resources while traveling by automobile, motorcycle, or snowmobile. For the more energetic, roads with low traffic levels can be safely used by bicyclists and horseback riders and by those wishing to simply walk along a country road to enjoy the outdoors. Public roads also provide travel routes to public accesses for hunting, fishing, canoeing, and boating.

While a limited number of roads and facilities may be beneficial, too many quite possibly will adversely affect a PWA. Every road that goes over or near the Boone River takes away some of its natural character. Existing roads along the Boone River provide plenty of opportunities for pleasure driving, riding, and walking, as well as access to the river itself for canoe, boating, and fishing. Proposals for new roads must consider all these factors and place higher priority on alternative routes outside the PWA when feasible and practical.

Road improvements and/or realignments will occasionally be necessary within the Boone River PWA. The ICC will encourage that the following guidelines be followed:

1. All abandoned bridges shall be torn down and removed from the site, except those having documented historical or cultural significance, or recreational potential (i.e. trail crossing, fishing access, etc.).

2. No changes to the existing river channel shall be made and vegetation removal and topographic alterations shall be kept at a minimum to control bank erosion and road undercuts, except in situations where no other solution is available.

3. Vegetation screens shall be used to buffer the visual and audio impacts that the road improvement and its traffic have on visitors of the river.

Private farm and forest lanes also exist along the Boone River. These private roads generally do not conflict with the PWA program unless they are susceptible to severe erosion. When needed, the ICC will provide technical assistance to landowners with an erosion problem on their existing roads. Also, the ICC will appreciate the opportunity to help landowners in designing new roads in a manner which will be consistent with the PWA program. In areas where the topography and resources are very sensitive to any kind of traffic, such as low-lying marshy or excessively steep sites, ICC-landowner agreements may specify that ICC approval will be needed prior to road construction and use.

Landscape Modifications

Land excavation and filling for any purpose (construction, sand and gravel mining, landscaping, etc.) should be kept to a minimum in the Boone River PWA. The following are general guidelines for earthmoving projects:

1. The smallest amount of bare ground is exposed for as short a time as possible.
2. Temporary ground cover (mulch) and sediment traps are used during construction to restrain erosion. Permanent ground cover, such as native prairie grasses and shrubs, is planted after construction to revegetate the excavated area.
3. Fill and cuts are stabilized to prevent sloughing and other secondary ground movements.

Landfills and other refuse disposal sites of any size are landscape modifications which conflict with the Boone River PWA designation. Whenever possible, the ICC-landowner agreements will specify that refuse disposal sites are prohibited in the PWA. The ICC will make cooperative arrangements with landowners to remove any existing rubbish along the river.

The ICC will oppose all proposals that alter the Boone River's free-flowing character, including channel changes and impoundments. Channelization and dams have devastating long-term impacts on a river's natural character and directly conflict with the PWA designation.

Oil Exploration and Drilling

Search for oil and gas is occurring in portions of southeast, southwest, and central Iowa. The Boone River PWA is within the central Iowa exploration zone. Geologists feel oil may have been formed in this zone in Precambrian source rocks located between 1,500 and 40,000 feet below the surface (Anderson, 1984).

Oil companies are pursuing exploration leases with landowners. These leases are not expected to conflict with the PWA designation since the exploration is being conducted with seismic wave equipment. Drill sites for testing and mining will unlikely be located on the valleydes and floodplain, since the possible oil source is so deep that little advantage would be received by drilling at an elevation just 50 to 60 feet less than the nearby uplands. The ICC will continue to monitor oil exploration efforts in the Boone River PWA in regards to natural and cultural resource impacts. The Iowa Geological Survey is the primary information source for this subject.

CHAPTER EIGHT
ADMINISTRATIVE REQUIREMENTS

The PWA program to date has been entirely in a planning phase within the responsibilities of the ICC's Planning Section. PWA designation of the Boone River advanced the program into its implementation phase and will require an operations section of the ICC to administer the designation. The Wildlife Section has been given this responsibility since much of the Boone River PWA is within their project area for the expansion of the Boone Forks Wildlife Management Area. The Wildlife Section will require assistance from the Forestry, Fisheries, Land Acquisition, and Planning Sections to accomplish the recommended multiple use management of the area. The Hamilton County Conservation Board will also be available for management assistance.

Administrative requirements for the Boone River PWA are categorized into four basic components:

1. Administrative actions by agencies;
2. Protection agreements with landowners;
3. Facility developments; and
4. Resource and public use management.

These components are presented in this chapter, with particular references to staff responsibilities and funding requirements. The chapter concludes with a description of potential funding sources available for Boone River PWA implementation.

Administrative Actions by Agencies

The ICC designated the Boone River from its mouth to its confluence with Brewers Creek in Webster City into the Protected Water Areas system. This action was in accordance with Chapter 108A.8, 1985 Code of Iowa (shown below).

> 108A.8. DESIGNATION. The commission may adopt the management plan and may permanently designate the area into the protected water area system. Upon the commission adopting the management plan and permanently designating the area as a protected water area, the commission may submit the management plan to the legislature for funding consideration.

The ICC is required to hold a public hearing in the vicinity of proposed PWAs at least thirty days prior to permanent designation. The hearing for the Boone River was held on March 26, 1985, and it is summarized in Chapter 6 of this management plan.

Other agencies can complement the ICC's Boone River PWA designation by recognizing the area's natural and cultural resource values in respect to their associated programs and policies. The Iowa Department of Water, Air and Waste Management (DWAWM) is currently considering adding the Boone River, along with several other

rivers that have a high potential for inclusion in the PWA program, on the list of High Quality Resource Waters within their Water Quality Standards Regulation. The intent of this action by DWAWM is to assure that the water features are not subjected to adverse impacts caused by man's construction and developments. The ICC supports this DWAWM action, since maintenance of the river's good water quality will complement the PWA agreements with adjacent landowners to provide more comprehensive resource management.

The DWAWM is also proposing to include the Boone River in the Class A, Primary Contact Recreation classification within their Water Quality Standards Regulations. This designation will assure that the river's water quality is compatible with water body contact activities such as wading, swimming, and canoeing. The ICC supports this DWAWM action, since these are all popular recreation activities in the Boone River.

DWAWM administers a program called "Protected Streams" that prohibits channelization or straightening of designated rivers. Inclusion of the Boone River in this program will assure additional complementary protection. "Any state agency, government subdivision, association or interested person may petition the commission (DWAWM), according to the rules of the division, to designate a stream as a protected stream" (Chapter 900—72.5(1), Iowa Administrative Code, 1983). The ICC will petition the DWAWM to designate the Boone River PWA as a "protected stream." DWAWM also regulates water withdrawals from rivers and waste discharges to the river. Twenty-four cubic feet per second (24 c.f.s.) is the current designated protected flow rate for the Boone River at Webster City governing consumptive withdrawals from the river. Effluent limits into the Boone River are governed by a designated flow of 4.3 c.f.s. at Webster City. The ICC supports both of these existing flow rate designations and does not currently recommend a change in them.

The Iowa Department of Soil Conservation, U.S. Soil Conservation Service (SCS), and Agricultural Stabilization and Conservation Service (ASCS) administer various technical and financial assistance programs for soil conservation. The ICC recommends that these agencies place a high priority on assistance for soil conservation measures within the Boone River PWA watershed.

Various federal, state, and local agencies not mentioned above also administer programs which could impact Boone River resource management. The ICC, as a general rule, recommends that all agencies recognize the Boone River PWA designation and administer their programs in a manner consistent with goals and objectives represented in Chapter One of this Management Plan.

Protection Agreements with Landowners

Protection agreements with landowners are the most critical components of Boone River PWA implementation. PWA designation would merely be academic if effective agreements are not sought, developed, and maintained. Staff time and funds for the agreements must be given top priority within PWA implementation activities.

The first step in developing the protection agreements is to determine which method each landowner is interested in and the conditions to be specified in it. This can only be accomplished by individually visiting with the landowners and mutually developing the agreement. The person contacting the landowners must be thoroughly knowledgeable on the PWA program, alternative protection methods, the assessed value of the agreement, property and income tax implications, and negotiation procedures. The ICC's Land Acquisition Section has staff with the required expertise.

Forty-three (43) landowners have indicated they are interested in being contacted to begin PWA agreement negotiations. PWA agreements should commence by July 1, 1985, in order to maintain the program's momentum after the ICC's permanent designation. An equivalent of

Table VIII-1
Estimated Costs of Boone River PWA Agreements

	Number of Landowners*	Number of Acres	Per Acre Cost of Agreement	Total Cost for for Agreements
Fee title land sale	9	538	$200 - $400	$107,600 - $215,200
Easement donation	7	212	$0	$0
Lease sale	1	97	$100 - $200	$ 9,700 - $ 19,400
Lease donation	4	149	$0	$0
Property tax incentive	1	35	$0	$0
Undetermined, no compensation	3	65	$0	$0
Undetermined, w/ compensation	5	669	$200 - $400**	$133,800 - $267,600
Undetermined and unknown whether or not compensation required	13	394	$100 - $400***	$ 39,400 - $157,600
TOTAL	43	2,159		$290,500 - $659,800 (mid range = $475,150)

* From Table VI-3 in Chapter Six.

** Cost of fee title land sale is used for estimation purposes. Actual cost may be less.

*** Large range is used for estimation purposes, since actual costs will be variable.

one full-time staff position will be required for negotiations during the first six months of implementation and one-quarter to one-half a position thereafter for one and one-half years.

PWA agreements will undoubtedly come in many forms ranging in costs from none to thousands of dollars. Table VIII-1 presents estimated costs for the protection agreements with landowners based upon preliminary discussions with them.

The average cost per acre for PWA agreements using the mid range total cost exemplified in Table VIII-1 is $220. Assuming that this same average is applicable to those landowners not interested in negotiating at this time, the total cost of PWA agreements will be approximately $1.22 million. This total cost when distributed over a ten-year period equals $122,000 per year, which is the amount the Wildlife Section will include in an annual budget request from the General Fund for Boone River PWA agreements.

The PWA law requires the state of Iowa "reimburse from the general fund of the state any political subdivision the amount of tax monies lost due to any lower assessments of property resulting from lease agreements, and the acquisition of public lands and conservation easements stemming from designation of a protected water area" (Chapter 108A.12, 1985 Code of Iowa). Approximately $2.00 per acre per year will need to be reimbursed to local subdivisions for the property contained in the protection agreements. These reimbursements will come from a standing unlimited appropriation from the state's general fund.

PWA agreements will need to be monitored to assure they are accomplishing program goals. Easement, lease, state preserve, and property tax incentive lands will have to be inspected annually and the results discussed with the landowner. The ICC's local wildlife biologist will be responsible for these inspections. He may seek assistance from Hamilton CCB staff when the number of agreements exceeds his work load capabilities.

Facility Developments

The Boone River currently has conveniently located public accesses throughout the PWA segment (see Chapter 2). These provide anglers, canoeists, and other river users relatively easy access to the river. The Bever Bridge access is privately owned and the Hamilton CCB has an agreement with the landowner for public use. The CCB maintains litter barrels on the area and patrols the public use.

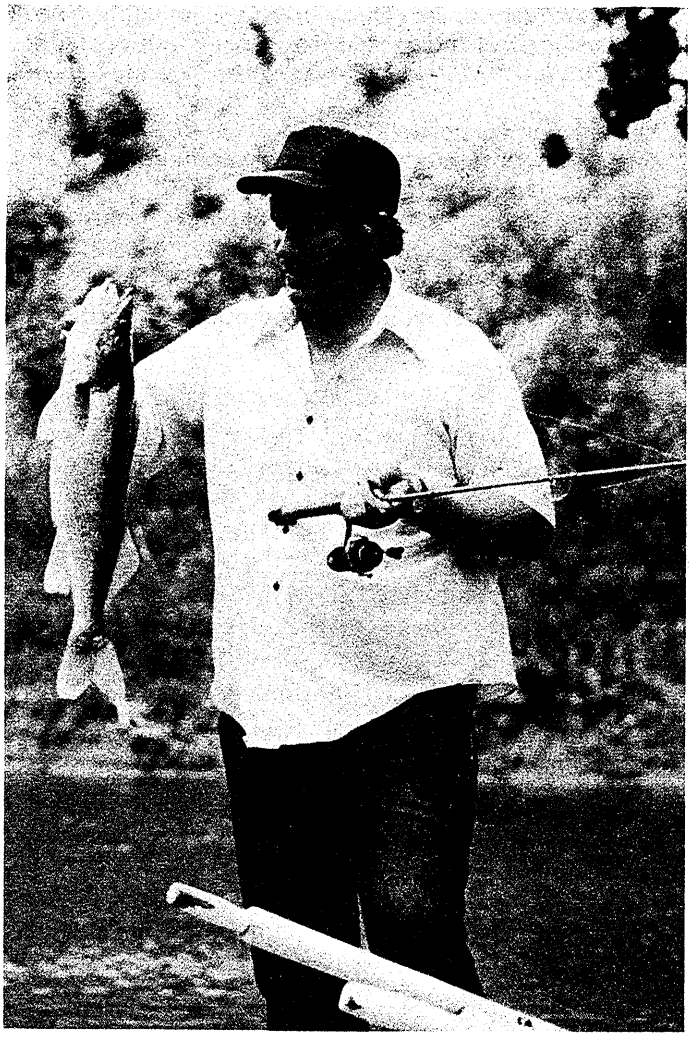
The agreement with the landowner has worked well, but it does have two disadvantages. First, no guarantee exists that the site will remain available for public use as land ownership changes. Second, no parking area is developed for the access, so river users park their vehicles and trailers along the road. Local traffic flow is impeded during times of high public use at the access.

Public ownership of the Bever Bridge Access site is recommended since it is heavily used by canoeists. The purchase should include the land between the river and road, as well as an area for vehicle and trailer parking. The ICC and Hamilton CCB should jointly pursue the design, acquisition, and development of the area. Total estimated cost of the acquisition and development is $5,000 - $7,000.

No other facility developments are recommended in association with the PWA designation.

Resource and Public Use Management

Resource management on the Boone River will be accomplished by the coordinated efforts of landowners, ICC, and the Hamilton CCB. The ICC's Wildlife Section will oversee the area's management and call upon available expertise as needed from other ICC sections and the Hamilton County Conservation Board. Technical assistance will be provided to landowners upon their request to help maintain the overall quality of the Boone River PWA. This management plan will serve as a guide to management activities.



The Boone River currently receives relatively heavy canoe, fishing, and hunting use. PWA designation may attract additional public use. A public use survey needs to be conducted for the Boone River to obtain the information required to develop a public use management program. The survey should collect the following information:

1. Who uses the Boone River;
2. Type and amount of river use;
3. User's perception of river quality;
4. User's perception of available facilities; and
5. User's contacts with landowners.

The ICC's Planning Section will be responsible for designing and administering the survey.

Public use management on the Boone River PWA is just as important as resource management. Recreationists must respect both the sensitivity of resources being protected

and the rights of adjacent landowners. A public relations program consisting of the following activities should be conducted on the Boone River PWA if survey results identify the need.

1. Supervising activity and maintaining order at public access sites; 2. Establishing dialogue with the public, stressing appropriate water area use, safety aspects, and cautions against littering, trespassing, and rowdyism.
3. Developing and presenting educational programs and informational materials for water area users;
4. Organizing water area clean-up and rehabilitation projects using local and special groups for volunteer labor;
5. Collecting and disposing of trash from public access areas;
6. Developing a positive relationship between landowners in protected water areas and the ICC, and assisting landowners where appropriate in solving resource management and public use problems; and
7. Establishing a cooperative relationship with local canoe rental businesses.

These work activities would be accomplished during the busy recreation times, with emphasis on canoeing and hunting seasons. The ICC's local conservation officer, with assistance from Hamilton County Conservation Board staff, may be able to accomplish the activities.

Funding Sources

All Boone River PWA funds will be administered through the ICC's Wildlife Section. The basic funding source will need to be the state of Iowa's General Fund. Supplemental funding may be available through existing conservation and recreation programs, and through several federal and state cost-sharing programs. The following are examples of supplemental funding sources:

—Land and Water Conservation Fund
—Marine Fuel Tax Fund
—Watercraft and Snowmobile Registration Fees
—Fish and Wildlife Trust Fund
—Cost-sharing for Soil Conservation

Nonprofit, private organizations such as The Nature Conservancy and Iowa Natural Heritage Foundation may also provide financial assistance. All these funding sources are described in the Iowa Protected Water Areas General Plan (ICC, 1981).

LITERATURE CITED

Anderson, Raymond. 1984. "Searching for Iowa Oil," Iowa Geology, Volume No. 9, Iowa Geological Survey.

Christensen, C. L. and K. M. Quick. 1970. "Report on Formica Exsectoides Forel in Hamilton County," Proceedings of the Iowa Academy of Science, Volume 77.

Hamilton County Conservation Board (CCB). 1985. Personal Communication with Brian Holt, Executive Director.

Harlan, James R. and Everett R. Speaker. 1969. Iowa Fish and Fishing, Fourth Edition. Iowa Conservation Commission.

Highland, J. D., C. S. Fisher, J. R. Worster, L. D. Lockridge, J. E. Fenton, F. F. Rieckin, and L. I. Harmon. 1973. Soil Survey Legend - Iowa. U.S. Soil Conservation Service and Department of Agronomy, Iowa Agriculture Experiment Station.

Iowa Conservation Commission (ICC). 1978. Alternatives to Fee Title Land Acquisition.

Iowa Conservation Commission (ICC). 1980. Environmental Assessment and Program Narrative for Boone Forks Wildlife Management Area Land Acquisition Proposal.

Iowa Conservation Commission (ICC). 1981. Iowa Protected Water Areas General Plan.

Iowa Conservation Commission (ICC). 1983. County Conservation Board Area Directory, 1983-1984.

Iowa Department of Water, Air, and Waste Management (IDWAWM). 1985. Letter dated January 4, 1985, from James Weigand to the Iowa Conservation Commission.

Iowa Geological Survey (IGS). 1985. Letter dated January 17, 1985, from Donivan Gordan, Chief, Water Resources Division, IGS, to the Iowa Conservation Commission.

Iowa Natural Heritage Foundation. 1982. The Landowner Options.

Kantor, Effie McKinlay. 1912. "The Mills of the County," History of Hamilton County. S. J. Clarke Publishing Company, Chicago, Illinois.

Knoll, Dan. 1982. Boone River Guide.

Litton, K. Burton, Jr. 1977. "River Landscape Quality and Its Assessment," Proceedings: River Recreation Management and Research Symposium, Edited by David W. Lime and Clyde A. Fasick, North Central Forest Experiment Station, U.S. Forest Service, St. Paul, Minnesota.

Nass, Martin E. 1976. Hamilton County—Its Towns and Settlements. Hahne Press, Webster City, Iowa.

Ohlerking, Damon. 1975. A Common Beginning. MIDAS Council of Governments, Ft. Dodge, Iowa.

Palmer, E. Laurence. 1949. Fieldbook of Natural History. McGraw-Hill Company.

Prior, Jean C. 1976. A Regional Guide to Iowa Landforms. Iowa Geological Survey, State of Iowa.

Schwartz, Charles W. and Elizabeth R. Schwartz. 1981. The Wild Mammals of Missouri. Revised edition. University of Missouri Press and Missouri Department of Conservation, Columbia and London.

Soil Conservation Service (SCS). 1984. Soil Survey of Hamilton County, Iowa Advance Report - Part 1. U.S. Department of Agriculture.

University of Iowa. 1976. Boone River Winter Water Quality Survey. State Hygienic Laboratory.

University of Iowa. 1981. Boone River Winter Water Quality Survey. State Hygienic Laboratory.

APPENDICES

APPENDIX A

CHAPTER 108A

PROTECTED WATER AREA SYSTEM

Referred to in §109.1
Chapter 108A, Code 1983, Scenic Rivers System, repealed by 84 Acts, ch 1261, §1
See Table of Corresponding Sections of Code 1983 to Code 1985 at the end of Vol III

108A.1 Definitions.

As used in this chapter, unless the context otherwise requires:

1. *"Commission"* means the state conservation commission.

2. *"State plan"* means a long-range comprehensive document that states the goals and objectives of the protected water area system, establishes the procedure and criteria for prospective protected water area designation, provides the format for prospective area analysis, establishes a priority system for prospective area study, recommends potential areas for inclusion into the system, institutes interagency coordination, and outlines general administrative and management needs to develop and administer this system.

3. *"Management plan"* means the document that states the goals and objectives of a specific protected water area which has been proposed for designation, the specific description of the area to be protected, land use agreements with property owners, the specific management programming considerations for the area, the in-depth project evaluations, analysis, justifications, and cost estimates, the proposed acquisition of fee title and conservation easements and other agreements, and the specific design and layout of facilities.

4. *"Water area"* means a river, lake, wetland, or other body of water and adjacent lands where the use of those lands affects the integrity of the water resource.

5. *"Prospective protected water area"* means a water area designated by the commission for which an in-depth study for permanent designation as an element of the protected water area system is conducted. Such areas shall possess outstanding cultural and natural resource values such as water conservation, scenic, fish, wetland, forest, prairie, mineral, geological, historic, archaeological, recreation, education, water quality, or flood protection values.

6. *"Protected water area"* means a water area permanently designated by the commission for inclusion in the protected water area system.

7. *"Protected water area system"* means a total comprehensive program that includes the goals and objectives, the state plan, the individual management plans, the prospective protected water areas, the protected water areas, the acquisition of fee title and conservation easements and other agreements, and the administration and management of such areas.

8. *"Legislature"* means the Iowa general assembly.

9. *"Conservation easement"* means an easement as defined in section 111D.2.

84 Acts, ch 1261, §2
Referred to in §108A.4

Section 108A.1, Code 1983, repealed by 84 Acts, ch 1261, §1

108A.2 State plan.

The commission shall maintain a state plan for the design and establishment of an administrative framework of a protected water area system and those adjacent lands needed to protect the integrity of that system.

84 Acts, ch 1261, §4
Section 108A.2, Code 1983, repealed by 84 Acts, ch 1261, §1

108A.3 Nomination of prospective protected water areas.

After basic resource and user data are gathered by or provided to the commission and the commission deems an area has merit for inclusion into a protected water area system, it may nominate the area for prospective protected water area designation. Other public agencies, interest groups, or citizens, may also recommend nomination of water areas for consideration of inclusion into the protected water area system by submitting to the commission a statement which includes at minimum a general description of the area being recommended for nomination, the resources needing protection, and the benefits to be derived from protecting the resources and a list of the individuals, organizations, and public agencies supporting the nomination.

84 Acts, ch 1261, §5
Section 108A.3, Code 1983, repealed by 84 Acts, ch 1261, §1

108A.4 Prospective designation.

The commission may designate all or part of any water area having any or all of the resource values cited in section 108A.1, subsection 5, as a prospective protected water area. The prospective designation shall be in effect for a period not to exceed two years during which a management plan is prepared for the protection and enhancement of those values cited in section 108A.1, subsection 5.

84 Acts, ch 1261, §6

Section 108A.4, Code 1983, repealed by 84 Acts, ch 1261, §1

108A.5 Prospective designation public hearing.

After the nomination of prospective protected water areas by the commission and prior to the designation as a prospective protected water area, the commission shall conduct a public hearing in the vicinity of the water area. Notice of the hearing shall be published at least twice, not less than seven days prior to the hearing, in a newspaper having general circulation in each county in which the proposed water area is located.

84 Acts, ch 1261, §7

Section 108A.5, Code 1983, repealed by 84 Acts, ch 1261, §1

108A.6 Management plan.

The commission shall prepare and maintain a management plan containing the recommendations for the establishment, development, management, use, and administration of each prospective protected water area designated by the commission. The management plan shall be completed during the two-year prospective designation period.

84 Acts, ch 1261, §8

Section 108A.6, Code 1983, repealed by 84 Acts, ch 1261, §1

108A.7 Management plan public hearing.

The commission will hold a final public hearing on the completed management plan in the vicinity of the water area at least thirty days before permanent designation by the commission. Notice of the hearing shall be published at least twice, not less than seven days prior to the hearing, in a newspaper having general circulation in each county in which the water area is located.

84 Acts, ch 1261, §9

Section 108A.7, Code 1983, repealed by 84 Acts, ch 1261, §1

108A.8 Designation.

The commission may adopt the management plan and may permanently designate the area into the protected water area system. Upon the commission adopting the management plan and permanently designating the area as a protected water area, the commission may submit the management plan to the legislature for funding consideration.

84 Acts, ch 1261, §10

108A.9 Protection methods.

The commission may use any one or a combination of the available methods, except condemnation, for managing and preserving a protected water area, including but not limited to fee and less than fee title acquisition techniques, such as easements, leasing agreements, covenants, and existing tax incentive programs.

84 Acts, ch 1261, §11

108A.10 Landowner cooperation.

Recognizing that most of the protected water areas may be within privately owned lands, the legislature encourages the commission to cooperate with the landowners within the designated areas in achieving the purposes of this chapter. Likewise, the landowners within the designated areas are encouraged to cooperate with the commission. Commission staff shall meet separately or in small groups with landowners within interim protected water areas during the preparation of the master plan to establish workable and acceptable agreements for the protection of the area and its accompanying resources in a manner consistent with the purposes of this chapter and the interest and concerns of the landowner.

84 Acts, ch 1261, §12

108A.11 Judicial review.

Judicial review of action of the commission may be sought in accordance with chapter 17A. Notwithstanding chapter 17A, petitions for judicial review may be filed in the district court of Polk county or of any county in which the property affected is located.

84 Acts, ch 1261, §13

108A.12 Local tax reimbursement.

The state of Iowa shall reimburse from the general fund of the state any political subdivision the amount of tax moneys lost due to any lower assessments of property resulting from lease agreements, and the acquisition of public lands and conservation easements stemming from designation of a protected water area.

84 Acts, ch 1261, §14

108A.13 Interagency cooperation.

All state and local agencies shall cooperate with the commission and coordinate their authorities, responsibilities, and program administration in a manner which will aid in the integrity of the protected water area system as outlined in the state plan, individual management plans, and commission administrative rules.

84 Acts, ch 1261, §15

108A.14 Management cooperation with local government subdivisions.

The commission may enter into written cooperative agreements with county boards of supervisors, county conservation boards, and municipal public agencies, for the management of a protected water area.

84 Acts, ch 1261, §16

108A.15 Part of a national system.

This chapter does not preclude a component of the protected water area system from being a part of the national wild and scenic river system under the federal Wild and Scenic Rivers Act, 16 U.S.C., secs. 1271 through 1287. The commission may enter into a written cooperative agreement for joint federal-state administration of rivers which may be designated under that federal Act.

84 Acts, ch 1261, §17

108A.16 Departmental rules.

The commission shall adopt under chapter 17A and enforce the administrative rules it deems necessary to carry out this chapter.

84 Acts, ch 1261, §18

APPENDIX B

BOONE RIVER MAMMALS

HABITAT TYPE

MAMMAL SPECIES	Cropland	Stream/River	Open Pasture	Oldfield	Savanna	Upland Forest	Floodplain Forest	Prairie	Forest Edge	Roadsides	Farmstead	ESTIMATED ABUNDANCE
OPOSSUM	●					●	●			●	●	MODERATE
SHORT-TAILED SHREW				●	●	●	●		●			ABUNDANT
MASKED SHREW					●	●	●		●			ABUNDANT
EASTERN MOLE	●		●		●			●	●	●	●	ABUNDANT
COTTONTAIL RABBIT	●		●	●	●	●	●	●	●	●	●	ABUNDANT
WHITE-TAILED JACKRABBIT	●		●					●		●		RARE
WOODCHUCK			●		●			●		●	●	MODERATE
THIRTEEN-LINED GROUND SQUIRREL	●		●					●		●	●	ABUNDANT
FRANKLIN'S GROUND SQUIRREL	●		●					●	●	●	●	MODERATE
EASTERN CHIPMUNK					●	●	●		●			MODERATE
FOX SQUIRREL					●	●	●				●	ABUNDANT
SOUTHERN FLYING SQUIRREL						●	●					UNKNOWN
PLAINS-POCKET GOPHER	●		●					●		●	●	ABUNDANT
BEAVER		●					●					MODERATE
PRAIRIE WHITE-FOOTED MOUSE	●		●	●	●			●	●	●	●	ABUNDANT
WOODLAND WHITE-FOOTED MOUSE					●	●	●		●			ABUNDANT
MEADOW VOLE	●		●	●	●			●		●	●	ABUNDANT
WOODLAND VOLE						●	●		●			RARE (ENDANGERED)
WESTERN HARVEST MOUSE	●		●	●	●			●	●	●		MODERATE
NORWAY RAT											●	ABUNDANT
HOUSE MOUSE	●		●								●	ABUNDANT
MEADOW JUMPING MOUSE	●		●	●	●			●	●	●	●	MODERATE
COYOTE	●		●	●	●	●	●	●	●			MODERATE
RED FOX	●		●	●		●	●					MODERATE
GRAY FOX					●	●	●					RARE
RACCOON	●	●	●	●	●	●	●	●	●	●	●	ABUNDANT
LONG-TAILED WEASEL				●	●	●	●		●			UNKNOWN
SHORT-TAILED WEASEL												UNKNOWN
LEAST WEASEL												UNKNOWN
MINK		●					●					MODERATE
BADGER			●					●		●	●	MODERATE
SPOTTED SKUNK	●		●	●	●			●		●	●	UNKNOWN
STRIPED SKUNK	●		●	●	●	●	●	●	●	●	●	ABUNDANT
WHITE-TAILED DEER	●		●	●	●	●	●	●	●			MODERATE
MUSKRAT		●					●					MODERATE

APPENDIX C

TABLE C-1
BOONE RIVER BIRDS

A list of bird species that are regular summer residents of the Boone River Corridor and could be expected to be seen in the river or adjacent streamside vegetation.

Species	Status	Activity
Great-Blue Heron	Summer Resident	Feeding
Green-Backed Heron	Summer Resident	Feeding
Wood Duck	Summer Resident	Nesting*
Mallard	Summer Resident	Nesting
Turkey Vulture	Summer Resident	Feeding, Roosting
Red-Tailed Hawk	Permanent Resident	All
American Kestrel	Permanent Resident	All
Gray Partridge	Permanent Resident	All
Ring-Necked Pheasant	Permanent Resident	All
Ruffed Grouse	Permanent Resident**	All
Wild Turkey	Permanent Resident	All
Northern Bobwhite	Permanent Resident	All
Killdeer	Summer Resident	Nesting
Spotted Sandpiper	Summer Resident	Nesting
Upland Sandpiper	Summer Resident	Nesting
American Woodcock	Summer Resident	Nesting
Rock Dove	Permanent Resident	All
Mourning Dove	Summer Resident	Nesting
Black-Billed Cuckoo	Summer Resident	Nesting
Yellow-Billed Cuckoo	Summer Resident	Nesting
Common Screech Owl	Permanent Resident	All
Great-Horned Owl	Permanent Resident	All
Barred Owl	Permanent Resident	All
Whip-Poor-Will	Summer Resident	Nesting
Chimney Swift	Summer Resident	Nesting
Ruby-Throated Hummingbird	Summer Resident	Nesting
Belted Kingfisher	Summer Resident	Nesting
Red-Headed Woodpecker	Permanent Resident	All
Red-Bellied Woodpecker	Permanent Resident	All
Downy Woodpecker	Permanent Resident	All
Hairy Woodpecker	Permanent Resident	All
Northern Flicker	Summer Resident	Nesting
Eastern Wood-Peewee	Summer Resident	Nesting
Acadian Flycatcher	Summer Resident	Nesting
Eastern Phoebe	Summer Resident	Nesting
Great-Crested Flycatcher	Summer Resident	Nesting
Eastern Kingbird	Summer Resident	Nesting
Horned Lark	Permanent Resident	All
Purple Martin	Summer Resident	Nesting
Tree Swallow	Summer Resident	Nesting
Northern Rough-Winged Swallow	Summer Resident	Nesting
Bank Swallow	Summer Resident	Nesting
Cliff Swallow	Summer Resident	Nesting
Barn Swallow	Summer Resident	Nesting
Blue Jay	Permanent Resident	All
American Crow	Permanent Resident	All

Species	Status	Activity
Black-Capped Chickadee	Permanent Resident	All
Tufted Titmouse	Permanent Resident	All
White-Breasted Nuthatch	Permanent Resident	All
House Wren	Summer Resident	Nesting
Blue-Gray Gnatcatcher	Summer Resident	Nesting
Eastern Bluebird	Summer Resident	Nesting
Wood Thrush	Summer Resident	Nesting
American Robin	Summer Resident	Nesting
Gray Catbird	Summer Resident	Nesting
Brown Thrasher	Summer Resident	Nesting
Cedar Waxwing	Summer Resident	Nesting
European Starling	Permanent Resident	All
White-Eyed Vireo	Summer Resident	Nesting
Bell's Vireo	Summer Resident	Nesting
Warbling Vireo	Summer ResientNesting	
Red-Eyed Vireo	Summer Resident	Nesting
Yellow Warbler	Summer Resident	Nesting
American Redstart	Summer Resident	Nesting
Ovenbird	Summer Resident	Nesting
Common Yellowthroat	Summer Resident	Nesting
Scarlet Tanager	Summer Resident	Nesting
Northern Cardinal	Permanent Resident	All
Rose-Breasted Grosbeak	Summer Resident	Nesting
Indigo Bunting	Summer Resident	Nesting
Dickcissel	Summer Resident	Nesting
Rufous-Sided Towhee	Summer Resident	Nesting
Chipping Sparrow	Summer Resident	Nesting
Field Sparrow	Summer Resident	Nesting
Vesper Sparrow	Summer Resident	Nesting
Savannah Sparrow	Summer Resident	Nesting
Grasshopper Sparrow	Summer Resident	Nesting
Song Sparrow	Summer Resident	Nesting
Bobolink	Summer Resident	Nesting
Red-Winged Blackbird	Summer Resident	Nesting
Eastern Meadowlark	Permanent Resident	All
Western Meadowlark	Permanent Resident	All
Common Grackle	Permanent Resident	All
Brown-Headed Cowbird	Summer Resident	Nesting
Orchard Oriole	Summer Resident	Nesting
Northern Oriole	Summer Resident	Nesting
American Goldfinch	Permanent Resident	Nesting
House Sparrow	Permanent Resident	Nesting

*"Nesting" includes all activities associated with he summer breeding season.

**Ruffed Grouse were recently introduced. Success of the reintroduction is unknown at the present time.

TABLE C-2

A list of bird species that have been observed by Ron Muilenburg at Briggs Woods during the period 1964-1984.

LOONS
- X Common

GREBES
- X Horned
- X Eared†
- Western*†
- X Pied-billed

PELICANS
- American White

CORMORANTS
- X Double-crested

HERONS
- X Great Blue
- X Green
- Little Blue*
- Cattle Egret
- X Great Egret
- Snowy Egret*
- X Black-crowned Night
- X Yellow-crowned Night
- X Least Bittern
- X American Bittern

SWANS, GEESE, DUCKS
- Mute Swan*
- Whistling Swan*
- X Gr. White-fronted Goose
- X Snow Goose
- X Canada Goose
- X Wood Duck
- X American Wigeon
- X Gadwall
- X Green-winged Teal
- X Mallard
- X American Black Duck
- X Common Pintail
- X Blue-winged Teal
- Cinnamon Teal*†
- X Northern Shoveler
- X Canvasback
- X Redhead
- X Ring-necked Duck
- Greater Scaup*
- X Lesser Scaup
- Oldsquaw*
- X Bufflehead
- X Common Goldeneye
- X Hooded Merganser
- X Red-breasted Merganser
- X Common Merganser
- X Ruddy Duck

VULTURES, HAWKS, FALCONS
- X Turkey Vulture
- X Osprey
- X Bald Eagle
- X Northern Harrier
- X Northern Goshawk*
- X Sharp-shinned Hawk
- X Cooper's Hawk
- X Red-tailed Hawk
- X Red-shouldered Hawk*
- X Broad-winged Hawk
- Swainson's Hawk
- X Rough-legged Hawk
- Golden Eagle*
- X Peregrine Falcon*
- X Merlin*
- X American Kestrel

GROUSE, QUAILS, PHEASANTS
- X Ruffed Grouse
- X Common Bobwhite
- X Ring-necked Pheasant
- X Gray Partridge

TURKEYS
- X Wild Turkey

RAILS, GALLINULES, COOTS
- King Rail*
- Virginia Rail
- X Sora
- Common Gallinule
- X American Coot

AVOCETS
- American Avocet*†

PLOVERS
- X Semipalmated
- X Killdeer
- Piping*
- X Lesser Golden
- Black-bellied

SANDPIPERS, PHALAROPES
- Hudsonian Godwit
- Marbled Godwit*
- Whimbrel*
- X Upland Sandpiper
- X Greater Yellowlegs
- X Lesser Yellowlegs
- X Solitary Sandpiper
- X Willet
- X Spotted Sandpiper
- X Ruddy Turnstone*
- X Wilson's Phalarope
- Northern Phalarope*
- X American Woodcock
- X Common Snipe
- Short-billed Dowitcher
- X Long-billed Dowitcher
- Sanderling
- X Semipalmated Sandpiper
- Western Sandpiper
- X Least Sandpiper
- X White-rumped Sandpiper
- X Baird's Sandpiper
- X Pectoral Sandpiper
- X Dunlin
- Stilt Sandpiper
- Buff-breasted Sandpiper*

GULLS, TERNS
- X Herring Gull
- X Ring-billed Gull
- X Franklin's Gull
- Bonaparte's Gull
- X Forster's Tern
- X Common Tern
- Little Tern*
- X Caspian Tern
- X Black Tern

PIGEONS, DOVES
- X Rock Dove
- X Mourning Dove

CUCKOOS
- X Yellow-billed
- X Black-billed

OWLS Common Screech
- Barn*
- X Great Horned
- Snowy*
- X Barred
- Long-eared
- X Short-eared
- X Saw-whet

GOATSUCKERS, SWIFTS
- Chuck-will's-widow
- X Whip-poor-will
- X Common Nighthawk
- X Chimney Swift

HUMMINGBIRDS
- X Ruby-throated

KINGFISHERS
- X Belted

WOODPECKERS
- X Common Flicker
- Pileated
- X Red-bellied
- X Red-headed
- X Yellow-bellied Sapsucker
- X Hairy
- X Downy

TYRANT FLYCATCHERS
- X Eastern Kingbird
- Western Kingbird†
- X Great Crested Flycatcher
- X Eastern Phoebe
- X Yellow-bellied Flycatcher
- X Acadian Flycatcher
- Willow Flycatcher
- Alder Flycatcher
- X Least Flycatcher
- X Eastern Pewee
- X Olive-sided Flycatcher

LARKS, SWALLOWS
- X Horned Lark
- X Tree Swallow
- X Bank Swallow
- X Rough-winged Swallow
- X Barn Swallow
- X Cliff Swallow
- X Purple Martin

JAYS, CROWS
- X Blue Jay
- X American Crow

TITMICE
- X Black-capped Chickadee
- X Tufted Titmouse

NUTHATCHES, CREEPERS
- X White-breasted Nuthatch
- X Red-breasted Nuthatch
- X Brown Creeper

WRENS
- X House
- X Winter
- Bewick's*
- Carolina
- X Marsh
- X Sedge

MOCKINGBIRDS, THRASHERS
- X Northern Mockingbird
- X Gray Catbird
- X Brown Thrasher

THRUSHES
- X American Robin
- X Wood Thrush
- X Hermit Thrush
- X Swainson's Thrush
- X Gray-cheeked Thrush
- X Veery
- X Eastern Bluebird

GNATCATCHERS, KINGLETS
- X Blue-gray Gnatcatcher
- X Golden-crowned Kinglet
- X Ruby-crowned Kinglet

PIPITS, WAXWINGS
- Water Pipit
- Bohemian Waxwing*†
- X Cedar Waxwing

SHRIKES
- Northern*
- X Loggerhead

STARLINGS
- X European Starling

VIREOS
- X White-eyed*
- X Bell's
- X Yellow-throated
- X Solitary
- X Red-eyed
- X Philadelphia
- X Warbling

WOOD WARBLERS
- X Black-and-white
- Prothonotary
- X Worm-eating*
- Golden-winged
- Blue-winged
- X Tennessee
- X Orange-crowned
- X Nashville
- X Northern Parula
- X Yellow
- X Magnolia
- X Cape May
- Black-throated Blue*
- X Yellow-rumped
- X Black-throated Green
- X Cerulean
- X Blackburnian
- X Chestnut-sided
- X Bay-breasted
- X Blackpoll
- Pine*
- X Palm
- X Ovenbird
- X Northern Waterthrush
- Louisiana Waterthrush*
- Kentucky
- Connecticut*
- X Mourning
- X Common Yellowthroat
- Yellow-breasted Chat
- X Hooded*
- X Wilson's
- X Canada
- X American Redstart

WEAVER FINCHES
- X House Sparrow

MEADOWLARKS, BLACKBIRDS, ORIOLES
- X Bobolink
- X Eastern Meadowlark
- X Western Meadowlark
- X Yellow-headed Blackbird
- X Red-winged Blackbird
- X Orchard Oriole
- X Northern Oriole
- X Rusty Blackbird
- X Brewer's Blackbird†
- X Common Grackle
- X Brown-headed Cowbird

TANAGERS
- X Scarlet
- Summer

GROSBEAKS, FINCHES, SPARROWS, BUNTINGS
- X Northern Cardinal
- X Rose-breasted Grosbeak
- Blue Grosbeak†
- X Indigo Bunting
- X Dickcissel
- X Evening Grosbeak
- X Purple Finch
- X Common Redpoll
- X Pine Siskin
- X American Goldfinch
- Red Crossbill
- White-winged Crossbill
- X Rufous-sided Towhee
- X Savannah Sparrow
- X Grasshopper Sparrow
- Henslow's Sparrow*
- LeConte's Sparrow*
- Sharp-tailed Sparrow*
- X Vesper Sparrow
- X Lark Sparrow
- X Northern Junco
- American Tree Sparrow
- X Chipping Sparrow
- X Clay-colored Sparrow
- X Field Sparrow
- X Harris' Sparrow
- X White-crowned Sparrow
- X White-throated Sparrow
- X Fox Sparrow
- X Lincoln's Sparrow
- X Swamp Sparrow
- X Song Sparrow
- Lapland Longspur
- Snow Bunting

APPENDIX D

BOONE RIVER FISH

FISH SPECIES	Abundant	Moderately Abundant	Rare
NORTHERN PIKE		●	
BLACK BULLHEAD		●	
CHANNEL CATFISH	●		
FLATHEAD CATFISH			●
ROCK BASS		●	
SMALLMOUTH BASS	●		
WHITE CRAPPIE			●
BLACK CRAPPIE		●	
YELLOW PERCH			●
WALLEYE		●	
COMMON CARP	●		
RIVER CARPSUCKER	●		
QUILLBACK	●		
HIGHFIN CARPSUCKER	●		
CREEK CHUB*		●	
GOLDEN REDHORSE	●		
SHORTHEAD (NORTHERN) REDHORSE	●		
STONECAT		●	
BROOK STICKLEBACK*			●
GREEN SUNFISH	●		
ORANGE-SPOTTED SUNFISH		●	
JOHNNY DARTER		●	
BLACKSIDE DARTER			●

*COLLECTED IN A TRIBUTARY STREAM OF THE BOONE RIVER

FISH SPECIES	Abundant	Moderately Abundant	Rare
WHITE SUCKER		●	
NORTHERN HOG SUCKER		●	
BIGMOUTH BUFFALO	●		
FRESHWATER DRUM		●	
CENTRAL STONEROLLER		●	
BRASSY MINNOW		●	
EMERALD SHINER	●		
COMMON SHINER	●		
BIGMOUTH SHINER	●		
SPOTFIN SHINER	●		
SAND SHINER	●		
SUCKERMOUTH MINNOW		●	
BLUNTNOSE MINNOW	●		
BLACKNOSE DACE		●	

APPENDIX E
POTENTIAL CONDITIONS FOR BOONE RIVER PROTECTED WATER AREA CONSERVATION EASEMENTS AND LEASES

Proposed Property Use Restrictions

1. Construction of multiple family residences or developments such as apartment buildings, duplex houses, condominiums, mobile home parks, and subdivisions.
2. Commercial and industrial developments and commercial livestock feedlots of any nature.
3. Placement of commercial or promotional signs, billboards, or other advertising materials.
4. Filling, excavating, dredging, mining, drilling, or removing by any means topsoil, sand, gravel, rock, minerals, or other materials that change the topography of the protected property.
5. Construction of new roads.
6. Dumping of ashes, trash, garbage, or other unsightly or offensive material.
7. Changing of the topography through a landfill or dredge spoil operation by placing soil or other substance or material upon the protected property.
8. Construction of any kind upon or so near as to jeopardize the physical integrity of any documented archaeological site or historical burial mound without the prior written approval of the easement holder.
9. Installation of utility structures or lines upon or within the protected property without the prior written approval of the easement holder.
10. Introduction of nonnative plant species which may result in the decline or elimination of native plant species.
11. Introduction of nonnative animal species which may result in the decline or elimination of native animal species.
12. Changes of water courses such as impoundment, river and stream channel realignment, bank stabilization, or any other activity which is detrimental to the natural, meandering character of the Boone River and its tributaries without the prior written approval of the easement holder. This easement provision shall not in any way be construed as a means to circumvent or mullify local, state, and federal regulations pertaining to water course changes.
13. Pollution of surface or subsurface waters or springs with biocides, pesticides, herbicides, insecticides, or any other chemical substance. This easement provision shall not in any way be construed as a means to circumvent or nullify local, state, and federal regulations pertaining to water pollution.
14. Any act which, in the opinion of the easement holder, would be detrimental to the scenic beauty, fish and wildlife habitat, forests, natural beauty, and natural and archaeological resources of the protected property.
15. Grazing of cattle, horses, sheep, and other domestic livestock in woodlands.

Proposed Permitted Property Uses

1. Single family residential, including the maintenance of existing single family residential buildings and other nonresidential structures necessary to the residence and/or family business and the construction and maintenance of additional single family residential buildings and other nonresidential structures necessary to the residence and/or family business. All buildings shall be located and maintained in a manner consistent with the spirit and intent of this conservation easement.

Note: Portions of the protected property that are restricted for buildings and structures will be defined at the end of this paragraph. Generally, these restricted areas will be immediately adjacent to the Boone River and the steep hillsides and bluff tops within the line of sight from the Boone River.

2. The right to replace, rebuild, or alter any of the existing or additional structures allowed hereunder; however, any such replacement, rebuilding, or alteration shall be consistent with the intent of this agreement.
3. The right to excavate in connection with the maintenance, improvement, replacement, rebuilding, alteration, or construction of either of the structures authorized hereunder or of the water, sewage, and other services related to the residential use of the property.
4. The landowner retains title to all trees, standing or down, within the easement area, and the landowner further retains the rights to harvest timber commercially for lumber or firewood as provided in this section. The landowner shall harvest timber on a sustained yield basis only and shall conform with sound forest practices. The landowner retains no right to clear cut on the easement area except for wildlife enhancement or as recommended by a forest management plan.
   a. In connection with the above described reserved timber harvest rights, the landowner shall submit a timber harvest plan to the easement holder no fewer than sixty (60) days prior to the commencement of any timber harvesting program. Each such timber harvest plan shall include among its elements the location, size, and intended use of all roads to be constructed for timber harvest purposes. The easement holder shall have the sole power to approve each such plan, and its approval shall be predicated upon the manner in which each such plan guarantees the integrity of each of the following elements:

      (1) The aesthetic qualities of the Boone River and the easement area;

      (2) The wildlife habitat on the easement area; and

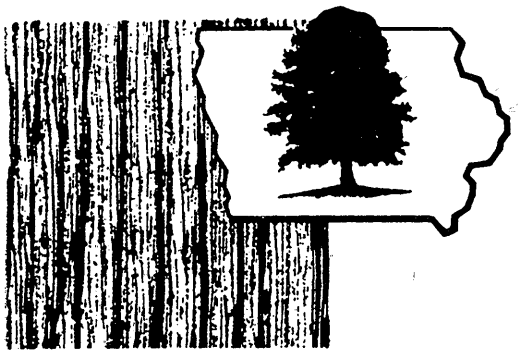
      (3) The water quality of the Boone River System, including its fisheries resources and the prevention of soil erosion.

The easement holder shall communicate its approval or disapproval of each such plan to the landowner within thirty (30) days of its receipt. Failure of the easement holder to communicate such approval or disapproval within said time period shall be deemed to be an approval of the plan as submitted. The easement holder shall not unreasonably withhold its approval of any such plan, it being the landowner's intention that this provision be used to protect the natural qualities of the easement area and not categorically to prohibit timber harvesting. No timber harvesting shall be conducted except in accordance with such an approved plan unless the easement holder has waived in writing the requirement for the submission of such a plan. Any such waiver by the easement holder shall be effective for one (1) year only. In the event of such waiver, the landowner shall nonetheless be required to conduct timber harvesting in such a manner as to safeguard the elements appearing immediately above as subparagraphs (1) through (3).

b. In the event that the landowner and the easement holder are unable to resolve disagreements over a specific timber harvest plan or other rights and permitted uses hereinafter contained within thirty (30) days, the matter shall be arbitrated. The easement holder and the landowner shall each select one arbiter and these two shall select a third. The decision of a majority of those three shall be final. Any cost of arbitration shall be borne equally between the landowner and the easement holder.

5. The right to cultivate certain lands for farming or personal gardens and orchards.
6. The right to introduce, manage, and/or reestablish trees, shrubs, prairie, forbs and grasses, or other plants generally consistent with the natural character of the area and which do not result in the decline or elimination of native species.
7. The right to construct and maintain foot trails.
8. The right to construct and maintain a canoe access.
9. The right to maintain and operate one pit for each dwelling for the disposal of personal trash, garbage, or other discarded materials. Such pit shall not be located within the restricted area defined in paragraph 1 above.
10. The right to maintain or rebuild existing roadways.
11. The right to modify, alter, construct, or reconstruct any waste disposal system shall be done in a manner that will prevent discharge of any waste into fresh waters located in or about the property.
12. The right to post the property to control unauthorized use.
13. The right to erect temporary signs to advertise the property for sale or for rent. Other commercial signs or billboards are prohibited except as may be necessary for the landowner's family business.
14. The right to clear and restore forest cover that is damaged or disturbed by the forces of nature.
15. The right to gather, use, or remove dead wood for noncommercial firewood use.
16. The right to prune or selectively thin trees to provide firewood for personal use and to create and maintain views from residential buildings.
17. The right to fish, hunt, and trap on the property and to allow fishing, hunting, and trapping by guests of the landowner.
18. The right to control predatory and problem animals by the use of selective control techniques subject to relevant sections of the Code of Iowa. Such controls will be given prior approval by the easement holder subject to the binding arbitration clause in 4.b above.
19. The right to construct and maintain fences.
20. The right to conduct scientific study or educational activities, in accordance with Chapter 109A, Code of Iowa (Management and Protection of Endangered Plants and Wildlife).
21. The right to recreational activities which do not impair the natural qualities of the area including the construction of unobtrusive trails, a picnic shelter, or a cabin for use only by the owner and his issues which are consistent with the intent of this agreement.
22. The right of wildlife species introductions after prior written approval by the easement holder (ICC) and which do not result in the decline or elimination of native species.
23. The right to pasture and graze cattle, horses, sheep, or other domestic livestock upon the nontimbered portion of the easement area to the extent that such use does not result in overgrazing or in the pollution of any surface or subsurface waters.
24. The right to allow cattle, horses, sheep, or other domestic livestock access to the Boone River and its tributaries for drinking and cooling water to the extent that such use does not result in objectionable levels of pollution in any surface or subsurface waters and in the erosion of river and stream banks.
25. The right to construct and maintain bank stabilization works and structures that are consistent with the spirit and intent of the agreement. This easement provision shall not in any way be construed as a means to circumvent or nullify local, state, and federal regulations pertaining to water course alterations.
26. The landowner, in conveying this conservation easement, need not permit or create any right of the public to enter upon the easement area for any purpose whatsoever.
27. The operation of snowmobiles, dune buggies, motorcycles, all terrain vehicles, or other types of motorized vehicles at locations and to the extent that does not result in objectionable levels of noise and soil erosion.

APPENDIX F



FORESTRY EXTENSION NOTES

GRAZING IOWA'S WOODLANDS

Livestock grazing of woodlands has been a long standing practice in Iowa. Grazing has occurred ever since the first European settlers came to Iowa in the 1800's. Since that time there has never been less than 50% of Iowa's woodlands being used for pasture. Today, more than 70% of Iowa's woodlands are grazed.

The practice of grazing has been questioned by many researchers. A great deal of research has been done concerning the effects of grazing on timber land. The results provide clear evidence that woodlands should not be grazed.

Despite concerns of professionals, landowners continue to graze their woodlands. Many landowners can not interpret the damage grazing has on the woodland. The trees appear healthy and woodlots appear parklike because grazing keeps the "brush" down. An examination of woodland grazing from the viewpoint of the farmer reveals many reasons for this practice which are really misconceptions. These include: 1) To derive the greatest monetary gain from the farm by using all the non-cropable land for grazing the maximum number of cattle; 2) To protect cattle by shading them on hot, sunny days and shielding them from wind and precipitation on stormy days; 3) To utilize low value timber that has few good trees to attract buyers; and, 4) To seek short term profits since there is no return on the timber management investments of planting, fencing, and weed control for many years, plus there is risk of fire and storm damage until harvest. Lack of knowledge on how to manage Iowa's woodlands also deters landowners from attempting to manage their woodlands.

The landowners' reasons for grazing their woodlands have been debated over the years. Many experiments have shown woodlot grazing to be damaging to the forest floor, trees, and livestock.

Soils. The effect of grazing on the forest floor and the associated soils are detrimental to the woodland itself. Grazing causes: 1) reduced amounts of soil organic matter, 2) increased soil compaction, 3) increased soil erosion, 4) reduced soil fertility.

prepared by Paul H. Wray, extension forester, and Reinee Hildebrandt, forestry extension assistant

F-350/May 1985

Cooperative Extension Service
Iowa State University
Ames, Iowa 50011

Investigations into the physical effects of grazing on soils supporting farm woodlands have shown that grazing reduces soil organic matter levels by as much as 25%. As the woodlot is grazed, understory plants are eliminated, crown density is reduced and tree vigor declines, resulting in less deposition of leaves and litter compared to the ungrazed woodlots. With the crown opened, the forest floor becomes warmer, causing the organic matter and litter to decay faster. The increase in the amount of sod in the grazed woodlot contributes organic matter due to dying grass roots, but this addition is not enough to offset the decline of tree and understory vegetation litter.

The compaction of soil by grazing leads to greater resistance of the soil to passage of air and water. This impermeability is the result of the destruction of the soil structure due to trampling or direct rainfall impact. When soils become compacted, they typically are characterized by lower initial moisture content in the spring and a greater tendency to dry out in the summer or fall. Grazed woodlots typically have lower soil moisture levels despite less moisture loss due to transpiration and less moisture interception by the dense crown cover of the ungrazed woodlot.

The impermeability of grazed woodlot soils leads to increased surface water runoff. For example, runoff from grazed forest floors (even with sod established under the remaining trees) averaged 344 cubic feet per year per acre over 7 years compared to less than 30 cubic feet per year per acre from comparable ungrazed woodlots. Severe erosion and soil loss can occur where woodlot grazing has been permitted and compaction has occurred.

In addition to physical effects, woodlot grazing affects the fertility of soil supporting farm woodlands. Litter removed from adjacent stands of grazed and ungrazed woodlots showed reduced fertility due to grazing, particularly in organic matter and available nutrients. This reduction in fertility is primarily due to less understory vegetation and tree litter, and the leaching and removal of nutrients by surface water runoff. Fertility reduction is critical because it occurs in the surface soil layers which serve as seedbeds for natural regeneration.

Trees. During woodlot pasturing the trees and associated vegetation are also affected. The diversity of plants decreases, tree reproduction decreases or is eliminated, and the trees become stressed and diseased.

The effects of reduced soil fertility on tree reproduction could be measured if the area was not browsed, trampled, and ridden down by livestock. Within a few weeks, cattle will begin to browse shrubs and foliage of young trees. In 5 to 10 years all reproduction will have been destroyed, and the lower limbs of the larger trees will be browsed back creating the "grazing line" common to all heavily-grazed woodlots.

The growth of trees remaining in the woodlot is also reduced due to grazing. As the litter layer is diminished and the soil becomes compacted, shallow root systems become exposed and vulnerable to trampling injuries. These injuries are potential disease entrance points that can further reduce the vigor of trees. Because there is no tree reproduction in a grazed woodlot, any large tree that is cut or dies results in reduced crown cover and stocking. This reduction in stand density corresponds to a reduction in periodic annual growth of the stand as a unit. Decreased volume growth is due to both adverse site changes associated with grazing and to decreased stand density itself.

The deterioration of the site quality of the grazed woodlot reduces the growth and quality of the timber. With the elimination of reproduction, the stand opens up. The eventual result is the elimination of all trees and the development of open land. Permanent pasture may well be economically desirable from management goal and may be quite suitable to the landscape, but many years of transition (should the gradual elimination of trees by woodlot grazing be allowed) create a situation where the land is not economically useful for grazing or the production of timber.

Livestock. The livestock can also be harmed by grazing woodlands. Research has shown that livestock loose weight when grazed in a woodland area. The other damage to livestock is they can be harmed by poisonous plants in the woodlands.

Actual forage value of woodlands is quite low. A woodland pasture yielded only 276 pounds of 8 percent protein forage per acre per year as opposed to 5,222 pounds of 15 percent protein per acre per year from a renovated and improved pasture. Cattle may not gain weight when grazed in farm woodlots without grain supplement. Four months of woodlot grazing at levels of 4 acres per animal unit and 6 acres per animal unit found weight losses in steers until they received a supplement of 3 pounds of corn per day. On the average, 30 acres of well stocked Iowa hardwoods are required to support an animal unit during the 6 month summer grazing season.

Poisonous plants can be a problem in graze woodlands. Poisonous annual plants include: pokeweed, cocklebur, hemlock, snake root, bracken fern, jimson weed, night shade, and jack-in-the-pulpit. Poisonous trees include: wild cherry, buckeye, kentucky coffeetree, oaks, and black locust. They may be poisonous only during certain seasons. Also only certain parts of the plant may be poisonous. Forestry Extension Note F-351 entitled, "Poisonous Plants Commonly Found in Woodlands," provides more information on the subject. This publication is available from Forestry Extension, 251 Bessey Hall, Iowa State University, Ames, IA 50011.

Alternatives to Grazing Woodlands

One of the major problems landowners have is that many of their pastures are fringed with timber. To fence around the border of the timber could be costly. A viable alternative to this is to separate the higher quality trees from the pasture and to convert the lower quality trees to pasture. By converting a small section of the woodland into pasture and using improved pasture management, the landowner will actually increase the amount of forage potential of the lands. By using good management practices on woodlands including the elimination of grazing, Iowa woodlands have the potential for economic return.

While the argument of increased farm revenue appears to be a benefit, closer observation indicates that the cost may actually out-weigh the benefit. Woodlot grazing is not considered a viable alternative of woodlot management. Realistically, the landowner has two management alternatives: (1) timber management. (2) conversion to pasture.

For help in improving the quality of your woodland and developing a timber management plan, contact your District Forester. For more information on timber management contact Forestry Extension, Iowa State University.

APPENDIX G

WOODLAND VOLE

Woodland Vole *(Microtus pinetorum)*

Name

The first part of the scientific name, *Microtus*, is from two Greek words and means "small ear" (*mikros*, "small," and *ous*, "ear"). This refers to the nearly concealed ears. The last part, *pinetorum*, is of Latin origin and means "belonging to the pines" (*pinetum*, "a pine woods," and *-orium*, "belonging to a place of"). This name refers to the Georgia pine forests where this species was first collected.

Other names used by different authorities are *Pitymys pinetorum* and *Pitymys nemoralis*.

The Woodland Vole is a small, thickset rodent with a large head, short legs, and a short tail that is about the same length as the hind foot. The eyes are small, and the ears are nearly concealed in the fur. The lips close tightly behind the upper incisor teeth, helping to keep dirt out of the mouth cavity when the vole digs underground. There are 4 toes and a small thumb on each front foot and 5 toes on each hind foot. The soles of the hind feet are furred from the heel to the 5 pads, or tubercles. The short, loose body fur is thick, soft, and glossy.

The Woodland Vole is distinguished from Prairie and Meadow voles by the shorter tail (tail nearly same length as hind foot) and from the Southern Bog Lemming by the absence of grooved incisors.

Color. The Woodland Vole is predominately reddish brown above, but the fur, when parted, shows an undercolor of dark gray. The sides are paler than the back, and the belly is grayish washed with buff; the hairs of the belly are dark at the base. The feet are grayish tan; the tail is dark above and only slightly lighter below. Occasional individuals are buffy or have white spots. The sexes are colored alike. Adults molt in early spring, throughout the summer, and again in late fall and early winter.

Measurements

Total length	3 1/4 – 5 3/4	in.	82 – 146	mm
Tail	5/8 – 1	in.	15 – 25	mm
Hind foot	5/8 – 3/4	in.	15 – 19	mm
Ear	5/16 – 7/16	in.	7 – 11	mm
Skull length	1	in.	25	mm
Skull width	5/8	in.	15	mm
Weight	3/4 – 2	oz.	21 – 56	g

Teeth and skull. The dental formula of the Woodland Vole is:

$$\text{I } \frac{1}{1}\ \text{C } \frac{0}{0}\ \text{P } \frac{0}{0}\ \text{M } \frac{3}{3} = 16$$

The grinding surfaces of the upper cheek teeth possess a pattern of sharp-angled enamel folds surrounding dentine. The second upper molar has 4 islands of dentine surrounded by enamel; the front border of the second island on the tongue side is squared on most specimens. There is no lengthwise groove on the outer edge of the upper incisors.

These dental characteristics distinguish the skull of the Woodland Vole from the closely related Meadow Vole, the Prairie Vole, and the Southern Bog Lemming.

Sex criteria. The sexes are identified as in the Eastern Wood Rat. There are two pairs of teats in the groin region of females.

Age criteria and longevity. Compared to adults, the young have darker, fuzzier, and more lead-colored fur. Age is also told by the smaller size. Woodland Voles seldom reach 10 to 12 months of age.

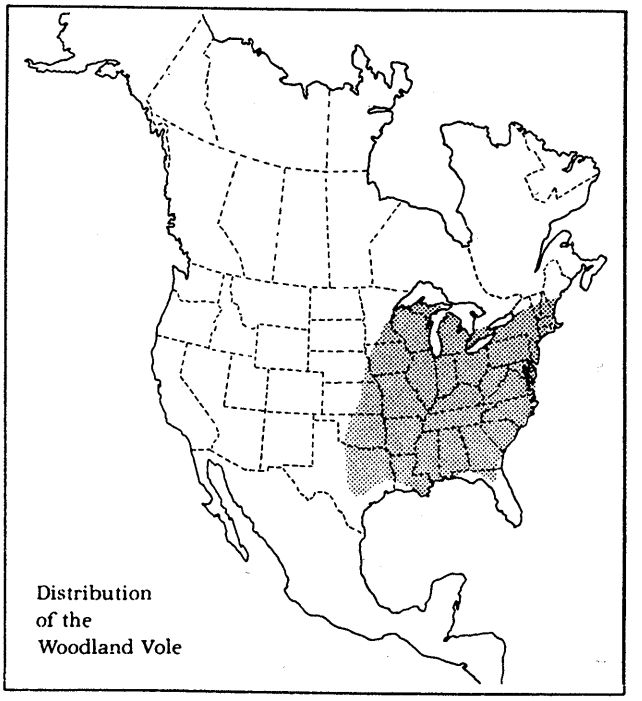
Glands. There are paired glands on the hips and in the groin region.

Voice and sounds. The Wooldand Vole gives low, birdlike chirps when alarmed or harassed. When fighting, it emits harsh chirrs.

Distribution and Abundance

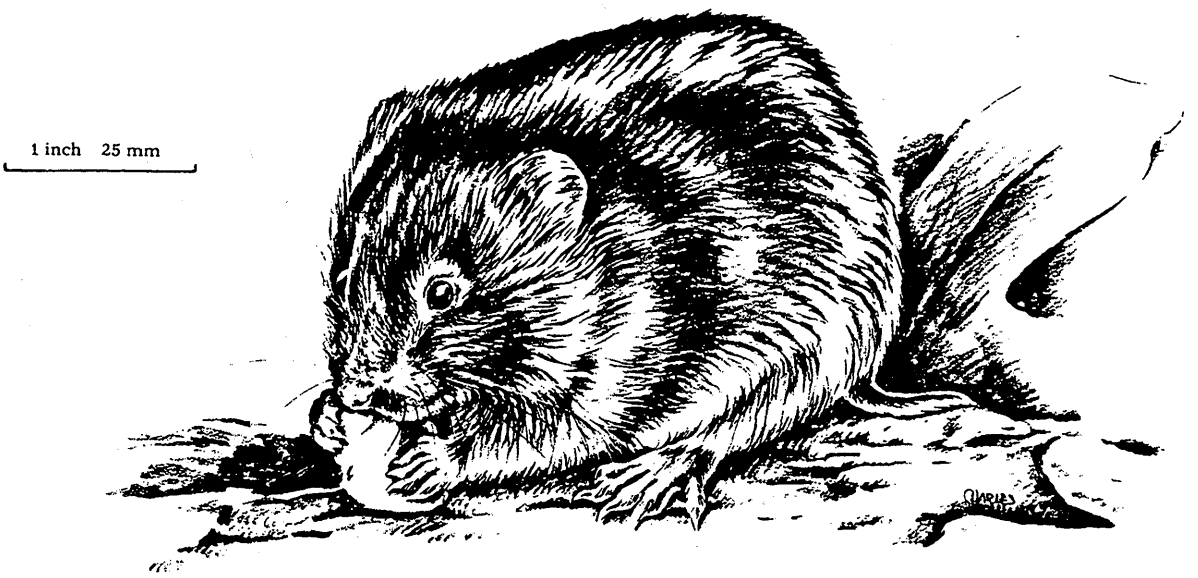
The Woodland Vole occurs throughout Missouri. It is generally rare but is most common in the Ozark Highland.

The North American distribution is shown on the accompanying map. The population shows periods of



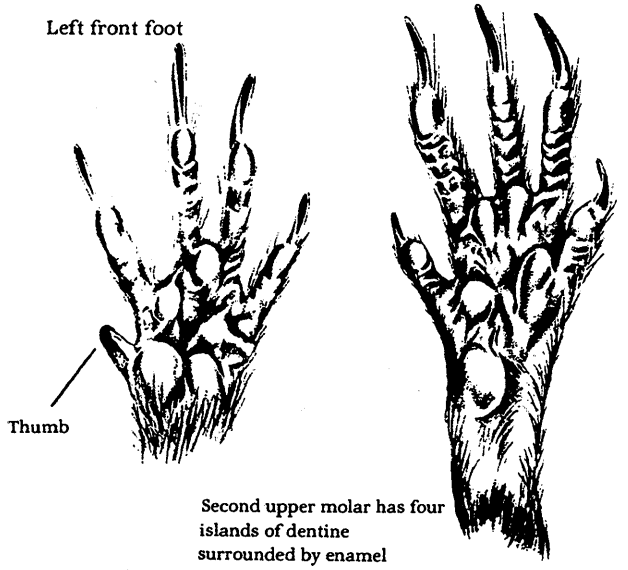
Distribution of the Woodland Vole

Woodland Vole *(Microtus pinetorum)*

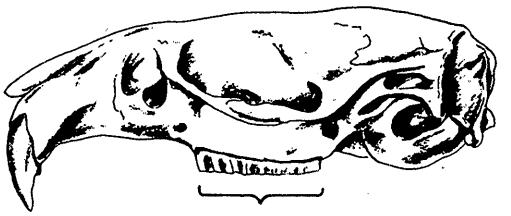


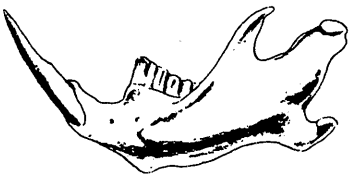
Left hind foot

Left front foot

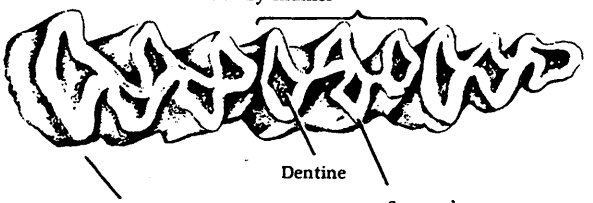


Skull—side view

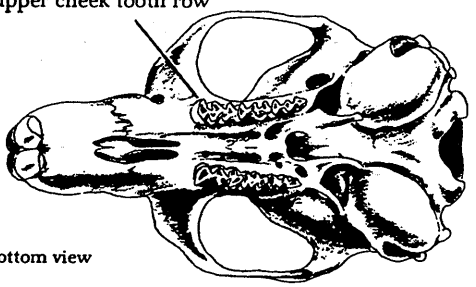




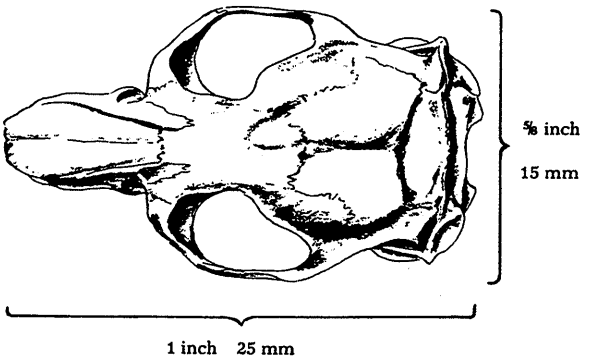
Second upper molar has four islands of dentine surrounded by enamel



Left upper cheek tooth row



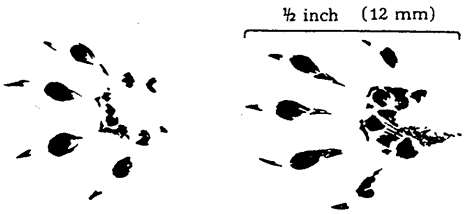
Skull—bottom view



Skull—top view

Woodland Vole tracks

Walking



Front foot

Hind foot

abundance every three to four years. Usually between 80 and 90 voles per acre is a high density, but in one locality during a population "high," densities reached 300 Woodland Voles per acre.

Habitat and Home

The Woodland Vole lives underground in oak-hickory forests and sometimes in mixed hardwood and pine forests where there is a heavy layer of dead leaves or a dense mat of grass and other cover. It also lives in fields adjacent to timber, and in orchards, gardens, and scrub areas, providing they possess considerable ground litter. Loose, moist soils are preferred because they are easy to dig.

The spherical nest is built beneath a log, just below the surface litter, or several inches underground. It consists of shredded dead grass, leaves, and rootlets with a lining of short, fine pieces of grass. There may be 3 to 4 entrances.

Habits

The Woodland Vole makes tunnels from 1 to 2 inches in diameter. These are just under the carpet of leaves and grass and from 4 to 12 or more inches deep. Numerous holes open at intervals from these tunnels and lead to surface feeding grounds. Piles of dirt, excavated from the tunnel system, may occur near these openings. Woodland Voles seldom travel far on top of the ground; they feed mostly in the tunnels.

In digging, the Woodland Vole uses its teeth, head, and front feet to loosen the soil and the hind feet to push the dirt behind. When a pile of dirt has accumulated, the vole pushes it out of the tunnel with its head. Although voles dig their own tunnels, they may use nearby tunnels of moles, shrews, and other kinds of mice.

Woodland Voles have a normal home range of about 1/4 to 1/3 acre. They may remain in this area for their entire lives or gradually shift their home, occupying new areas. Voles released up to 150 feet from the point of capture have returned to the home area.

These voles tend to live in colonies. They are not very aggressive but are more so than the Prairie Vole. There is a report of one nest containing 3 litters, presumably belonging to 2 or 3 females.

Woodland Voles do not hibernate and are slightly more active during the night than during the day. They are poor jumpers and climbers but are capable of swimming. They normally walk slowly but have been timed to run at a rate 3.8 miles per hour for 25 feet.

Foods

Because of its subterranean habits, much of this vole's food comes from below the surface of the ground. Succulent roots and tubers of many kinds of plants, sprouts, the tender bark of tree roots, stems, leaves, seeds, nuts, berries, apples, and an occasional insect or body of a dead Woodland Vole compose the diet. A fallen apple is consumed from the bottom by digging up underneath it.

Some food is stored in underground chambers that may contain as much as a gallon of tubers. When filled, the chamber entrance is closed with dirt. In captivity, Woodland Voles drink large amounts of water.

Reproduction

The breeding season encompasses most of the year, beginning in January and ending in November. The peak occurs in March and April. Several litters of 2 to 4 young, with extremes of 1 and 8, are born annually. The gestation period is about 21–24 days. From 1 to 6 litters may be born a year. The annual production is generally lower than that of Meadow and Prairie voles.

At birth the young are blind, naked, weigh about 1/10 ounce, and are between 1 1/4 and 1 3/8 inches long. They hang onto the female's teats very tenaciously and are often dragged about when she moves suddenly. At 5 to 6 days of age, fur appears and the incisors cut through the gums. The ears unfold on the eighth day, and the eyes open between the ninth and twelfth days. The young leave the nest for short periods by 2 weeks of age and are weaned between 16 and 21 days of age. The young develop adult fur and coloration when between 7 and 10 weeks old; they are ready to breed at 2 months.

Some Adverse Factors

Owls, hawks, snakes, opossums, coyotes, foxes, Domestic Cats, raccoons, and minks are known predators on Woodland Voles, although shrews, weasels, and other carnivorous mammals may also prey on this species. Predation, however, is probably light because of the Woodland Vole's subterranean existence. The reproductive rate also indicates that mortality is low in contrast to the Prairie Vole, which is more prolific and more heavily preyed upon.

The external parasites found on Woodland Voles are mites, ticks, lice, and fleas; the recorded internal parasites are tapeworm larvae, eggs of roundworms, and adult spiny-headed worms. A fatal skin disease frequently occurs in high populations.

Importance

Where Woodland Voles are abundant, they may damage orchard trees. They do this by their underground tunneling, severing of smaller roots, and girdling of larger roots. These voles may also reduce yields of truck crops by digging along rows of potatoes and other root vegetables. Rabbits are often blamed for the work of Woodland Voles.

The tunneling by this species contributes to aeration of the soil and helps prevent the rapid runoff of rain. Other interrelations of voles in general with their environment are given under the Prairie Vole.

Management or Control

Because of their underground habits, the control of Woodland Voles is often difficult. Where they are destructive in small areas, traps or poisoned bait placed in the tunnel system are effective methods of control. In orchards, clean cultivation eliminates the habitat of the Woodland Vole.

SELECTED REFERENCES

See also discussion of this species in general references, page 20.

Benton, A. H. 1955. Observations on the life history of the northern pine mouse. *Journal of Mammalogy* 36: 52–62.

Burt, W. H. 1940. Territorial behavior and populations of some small mammals in southern Michigan. University of Michigan, Museum of Zoology, Miscellaneous Publication 45: 7–58.

Hall, E. R., and E. L. Cockrum. 1953. A synopsis of the North American microtine rodents. University of Kansas Publications, Museum of Natural History 5: 373–498.

Hamilton, W. J., Jr. 1938. Life history notes on the northern pine mouse. *Journal of Mammalogy* 19: 163–70.

Miller, D. H., and L. L. Getz. 1969. Life-history notes on *Microtus pinetorum* in central Connecticut. *Journal of Mammalogy* 50: 777–84.

Novak, M. A., and L. L. Getz. 1969. Aggressive behavior of meadow voles and pine voles. *Journal of Mammalogy* 50: 637–39.

Paul, J. R. 1970. Observations on the ecology, populations, and reproductive biology of the pine vole in North Carolina. Report of Investigations 20, Illinois State Museum, Springfield. 28 pp.

Raynor, G. R. 1960. Three litters in a pine mouse nest. *Journal of Mammalogy* 41: 275.

Schadler, M. H., and M. Butterstein. 1979. Reproduction in the pine vole, *Microtus pinetorum*. *Journal of Mammalogy* 60: 841–44.

PROFESSIONAL SOURCES OF TECHNICAL INFORMATION

The following Iowa Conservation Commission staff provided technical information for this management plan.

Robert Barratt, former Superintendent of Wildlife

Mike Brandrup, District Forester

James Bulman, Regional Forester

Angela Corio, Conservation/Recreation Planner

Gene Hertel, State Forester

Laura Jackson, Urban Wildlife Biologist

Greig Jones, Wildlife Management Biologist

Roger Laushman, former Ecologist, Iowa Natural Areas Inventory

John Pearson, Ecologist, Iowa Natural Areas Inventory

Doug Reeves, Nongame Biologist

Dean Roosa, State Ecologist

Kevin Szcodronski, River Resources Planner

James Wahl, Fish Management Biologist

The following staff from other state agencies and private organizations provided technical information for this management plan:

David Ewert, Director of Science and Stewardship, The Nature Conservancy

Bill McGill, Resource Conservationist, Iowa Department of Soil Conservation

Ron Muilenburg, Amateur Ornithologist, Oskaloosa, Iowa

Jack Riessen, Chief of Floodplain Permits, Iowa Department of Water, Air, and Waste Management

Gerry Schnepf, Executive Director, Iowa Natural Heritage Foundation

Kay Simpson, Chief, Archaeological Survey, Office of Historic Preservation, Iowa Historical Department

Mike Smith, Assistant Attorney General, Environmental Law Division, Iowa Department of Justice

Joe Tiffany, Office of State Archaeologist, Iowa City

Ralph Turkle, Environmental Engineer, Iowa Department of Water, Air, and Waste Management

The photographs in this plan are from a slide presentation entitled "The Boone River" produced by Bob West, Mark, Wernlund, and Steve Wikner. The presentation was prepared for the Iowa Conservation in 1979 during a visual resources evaluation class in the Department of Landscape Architecture at Iowa State University.