



Records related to the establishment
of the Minnesota Valley National
Wildlife Refuge

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Waterfowl

Production Areas

MINNESOTA



WETLANDS FOR

• • • WATERFOWL



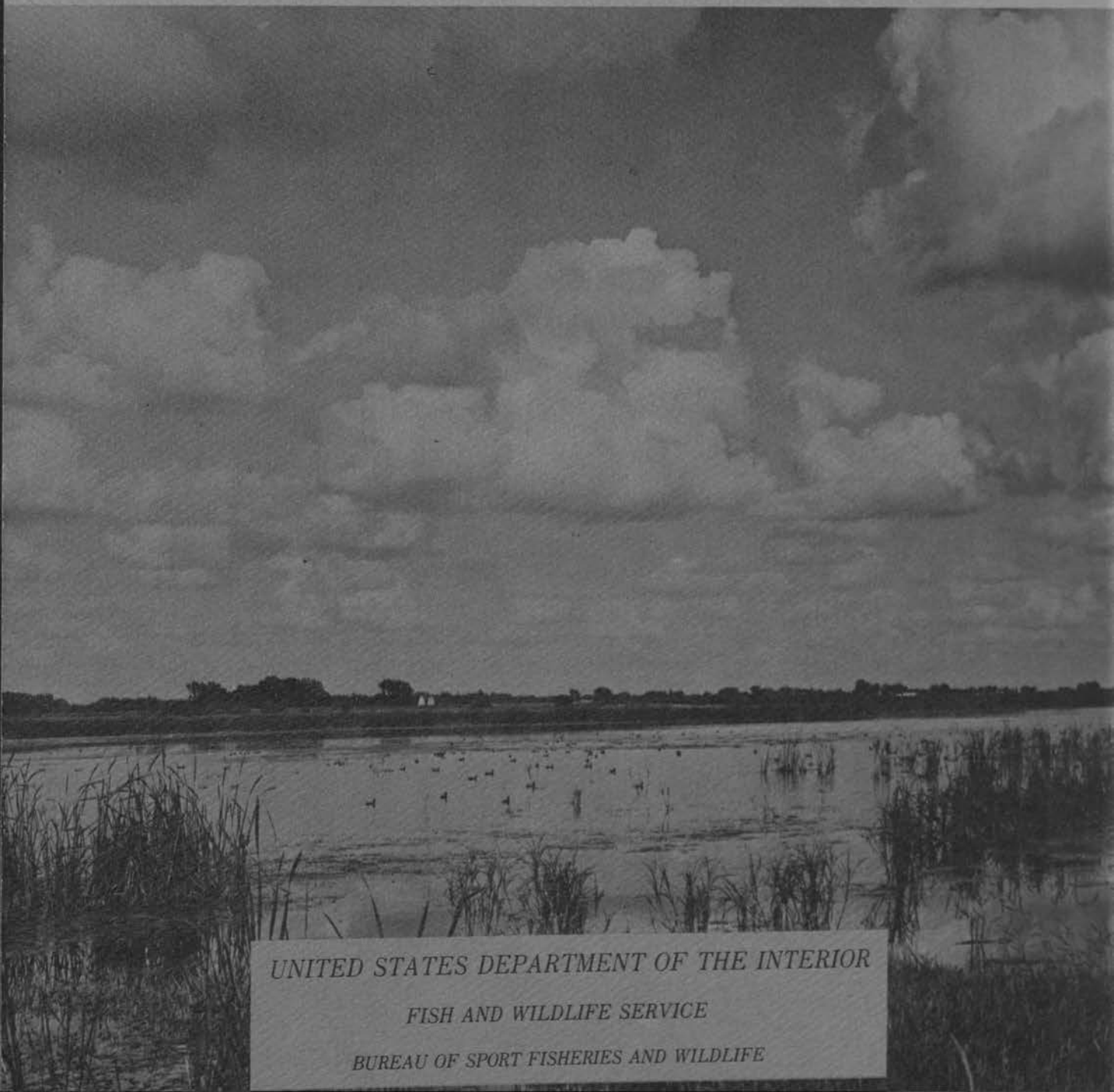
• • • OTHER WILDLIFE



• • • AND PEOPLE

*"First, all America has a stake in our migratory birds--
we must establish while we can, islands of natural
habitat and havens where our wildlife can rest and
reproduce."*

Stewart L. Udall
SECRETARY OF THE INTERIOR



UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE

The prairies of western Minnesota are dotted with lakes, marshes and potholes. These numerous and varied wetlands support rich plant and animal life.

Minnesota's Wetlands

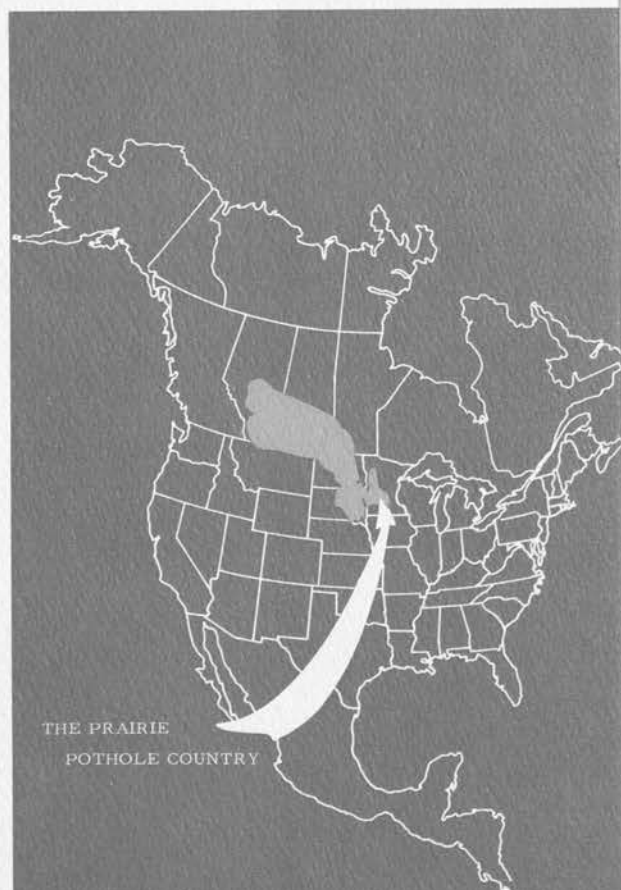
Without such wetlands, there can be no wild waterfowl. Wetlands produce ducks in abundance but also provide food, water and cover for other forms of wildlife. Man enjoys wetlands for the recreational opportunities they afford and should value them as water retention basins in the semi-arid high plains.

Since these wetlands are vital to man and his way of life, there is a public responsibility to see that they are preserved. The Bureau of Sport Fisheries and Wildlife is the federal agency charged with this responsibility.

Many of the more permanent wetlands will be preserved by public ownership. These lands will be actively managed and, in Minnesota, will eventually total about 1,000 areas averaging 100 to 150 acres each. Around these permanent wetlands, the small temporary wetlands will be protected from destruction through a payment to private landowners for their agreement not to drain, burn, fill or level these wetlands.

Development of purchased areas will include establishing waterfowl nesting cover, fencing and posting the areas for protection, and developing wildlife demonstration areas.

The estimated total development cost of the purchased areas in Minnesota will be \$3,500,000.



THE PRAIRIE
POTHOLE COUNTRY



THE WETLANDS

When the mammoth glaciers of the Ice Age retreated across the Northern Great Plains, millions of depressions were left on the landscape. Today, these depressions are lakes, marshes and potholes.

Commonly known as the "prairie pothole country", this water-speckled land is the backbone of duck production in North America. These wetlands are among the best duck-producing areas in the world.

While Minnesota's wetlands form but a portion of the total "pothole country", they are significant to wildlife and people of the state and nation.

*ducks and wetlands are
synonymous on the prairie*



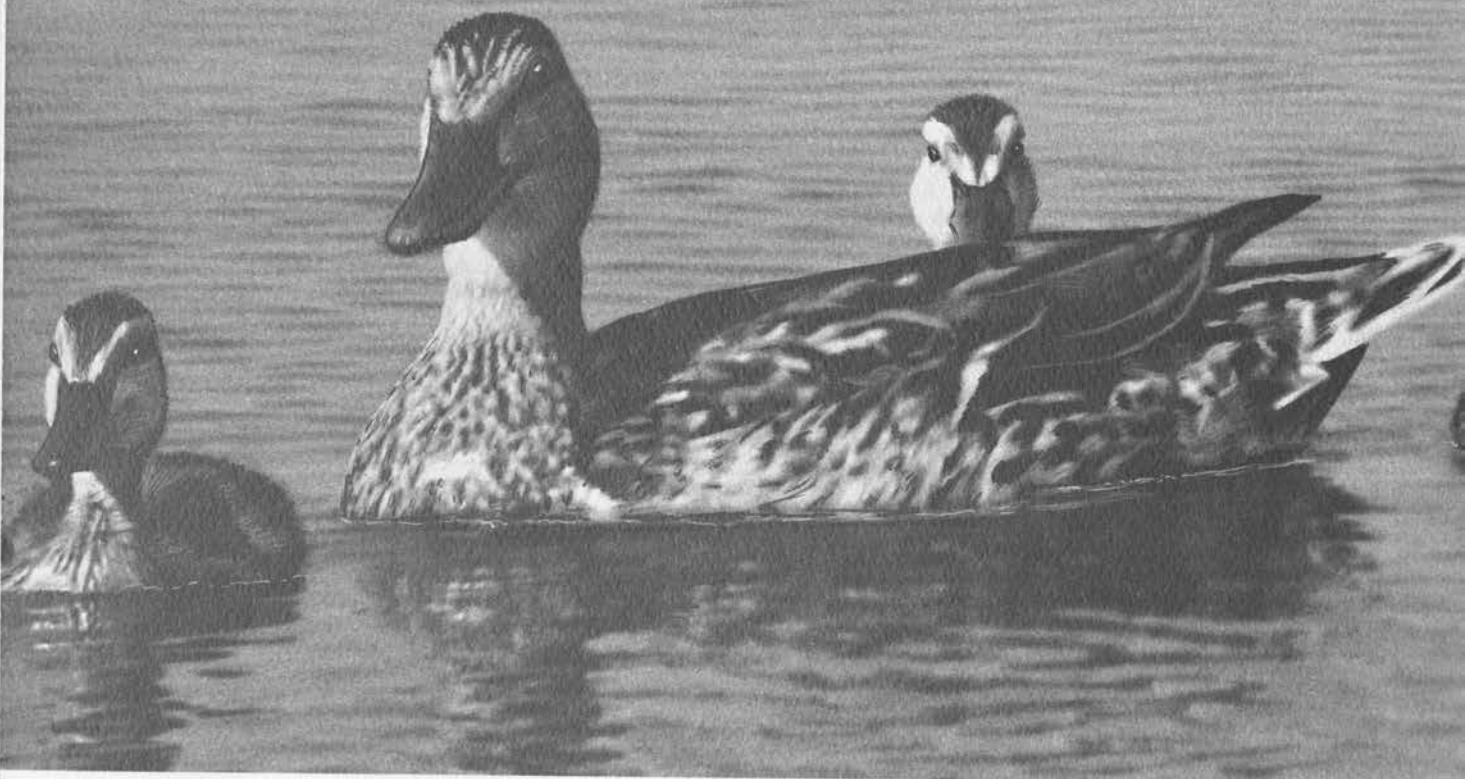


*wetland numbers and variety
characterize the "pothole country"*

The very distribution and variety of western Minnesota's wetlands make them attractive to waterfowl. Ranging from temporary sheet water which lasts only a few days in early spring to permanent lakes, marshes and potholes, they meet the varying breeding, nesting and migration needs of many waterfowl species.

Because they are numerous, densely distributed yet separate, varied in size and containing many types of vegetation, they have been able to meet the changing needs of waterfowl during their different stages of life. Minnesota wetlands usually are high in fertility and support many forms of plant and animal life.

These are the characteristics of the prairie wetlands which have made them the focal point in the continent's waterfowl production for untold centuries. Without these wetlands, North America's waterfowl would decline rapidly. With wetlands gone, the high plains would become a flat, featureless expanse of grass and grain.



THE VALUES

The history, tradition, culture and character of America has always included wildlife. Wildlife is a part of America's cultural past and present; its history when wildlife sustained the pioneers as food and fibre; its industry of years gone by; its health-giving outdoor recreation to active men and women; its grace and form in our natural landscape; its mystery to the curious; its lessons in family duty and affection between mother and young.

The wetlands community of wild flowers, grasses, birds and other wildlife gives us the sound, the color, the movement, the very pulse of the prairie. Man, in his awareness of this living wetlands community, renews his ties with nature.



*wetlands are vital
to duck production*

If man is to continue to enjoy waterfowl for all their values, he must preserve wetlands. Without wetlands, waterfowl and the myriad other forms of life in the wetlands community, cannot survive. The equation is that simple.

Today, the sportsman is only one of many Americans enjoying our wetlands.....the photographer, the botanist, the bird-watcher, the youngster with curiosity about his or her world, or those who find solace or inspiration in meditating on the mysteries of nature. What diminishes our wetlands resource diminishes all of us.

*wetlands offer a variety
of recreational opportunity*





wetlands are valuable natural reservoirs

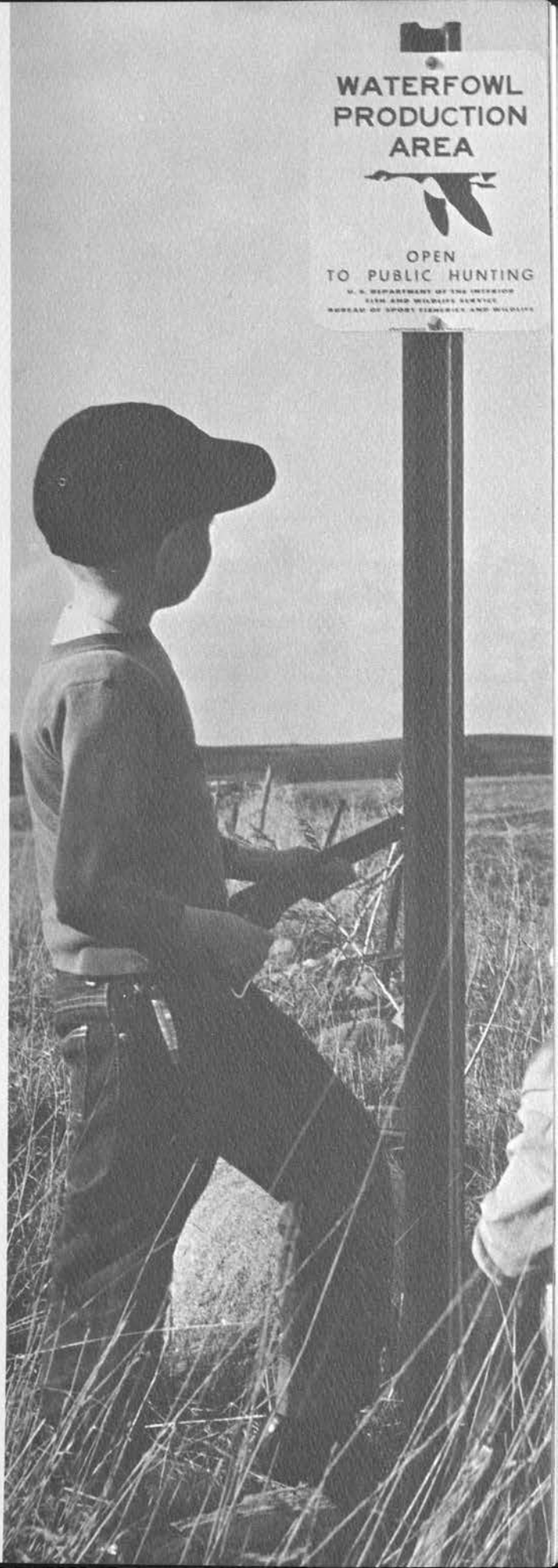
Wetlands have values beyond those of recreation and esthetics. They help maintain ground water levels in the high plains where soil moisture often spells the difference between abundance and crop failure. As water retention basins, wetlands are valuable in preventing more extensive damages in years of heavy runoff and flooding.

What is wildlife worth?

Certainly the values are real but, in the main, are intangible. Wildlife is valued primarily for esthetic reasons today and for the part it played in our earlier history.

But wildlife also has great economic value and wetlands, in their supporting role, are an important part of these values. Duck hunters alone spend \$87 million a year for such items as food, lodging, travel and equipment. Other users of the wetlands resource spend similar amounts. A typical waterfowl production area in Minnesota could easily return \$1,000 a year to the local economy from money spent by these people.

*wetlands preserved now are
an investment for the future*





THE THREATS

Legion flights of waterfowl once darkened the sky in spring and fall. But no more. More than half the nesting range of ducks in the prairie pothole country of the United States has been destroyed by drainage, and the ducks and all Americans have lost as a result.

Much of the prairie pothole country was put to the plow shortly after the Civil War. Between 1870 and 1930, farm crops followed the ditch and tile into those wetlands which were the easiest and cheapest to drain. The trend was temporarily reversed in the 1930's when one of the severest drouths in history caused us to hoard our precious water supply. Following World War II, the impetus for record crop production from every acre brought drainage into the pothole country in gigantic proportions. Many more thousands of wetlands acres faced permanent, man-made drouth for the first time.

Drainage was not the only threat facing wetlands and waterfowl. New highway construction created ditches into which feeder canals from the nearest potholes could be channeled. Watershed districts, organized to conserve soil and water resources, quite often were nothing more than drainage districts, with public funds once again used to destroy wetlands, a public resource.

A black and white photograph showing a deep, straight open ditch running through a flat, muddy landscape. The ditch is filled with water, and the surrounding area appears to be a drained wetland. In the background, there are some trees and a distant horizon under a clear sky.

*open ditch drainage is the
major threat to wetlands*



Poor land use, too, contributes to the steady dwindling of our wetlands. Many remaining potholes are surrounded by tilled fields where the absence of cover crops, soil fertility and crop rotations cause rapid erosion of topsoil into the potholes. Unfortunately, undue sedimentation will kill a pothole as surely as will a drainage ditch.

*siltation
as a
result of
erosion
destroys
many
wetlands*

Drainage ditches, single-purpose highway construction and watershed projects, siltation, pollution and other causes all destroy wetlands. Today, in some Minnesota counties, more than 15 per cent of the remaining wetlands are being destroyed annually. If the trend continues, all of the prairie wetlands will be gone in a few years. In creating this permanent drouth, man is also destroying a great natural heritage. By permitting this to happen, he must shoulder the responsibility forever.

*urban expansion is
taking its toll*





THE PRESERVATION

The cause and effect of the "Dirty Thirties" reawakened the conscience of many Americans to the realization of just how destructive this nation had allowed itself to be with its once-rich gift of natural resources. J.N. "Ding" Darling and many other conservationists repeatedly called attention to our abuse of our wetlands. Studies by the Fish and Wildlife Service in the late 1940's gave graphic evidence of the massive destruction of wetlands and signalled the need for immediate constructive action.

This action took several forms: restricted hunting seasons, particularly on those duck species most critically hurt; programs to better protect brood stock; efforts to slow down the massive drainage program; and action to reserve and replace wetlands for waterfowl.

*privately owned wetlands
are valuable for purposes
other than wildlife*

*public ownership means
wetlands forever*

*the Minnesota Conservation
Department has a progressive
wetlands preservation program*

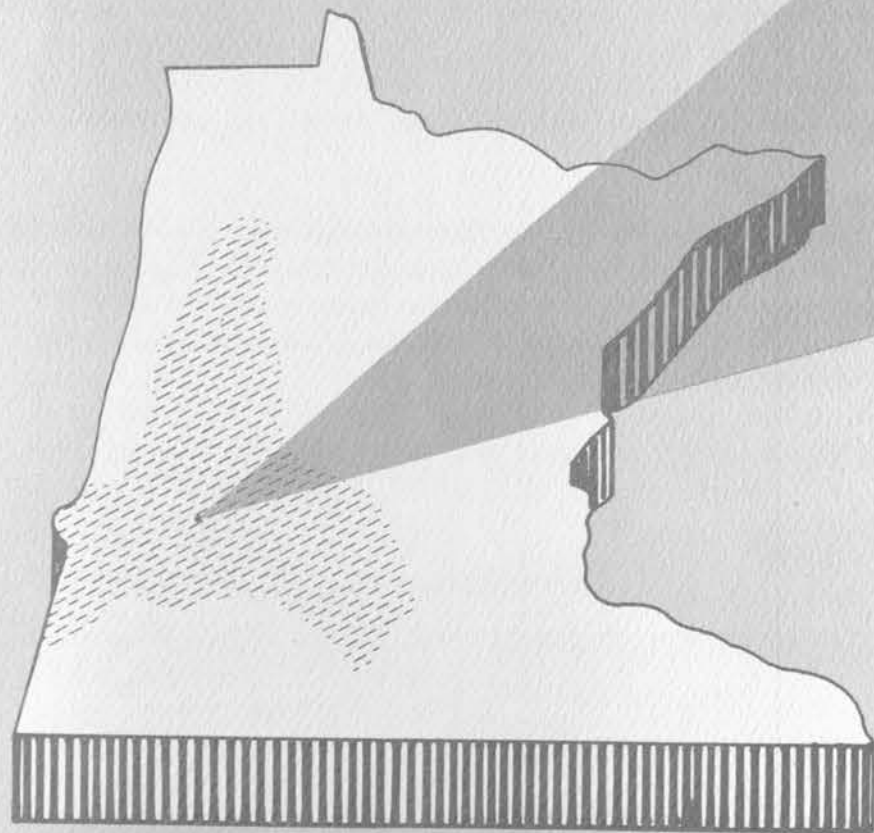
The alarming facts disclosed by the Service's studies brought widespread support for public acquisition of wetlands. Congress responded in 1958 by amending the Duck Stamp Act to authorize outright purchase and long-term easements of wetlands. However, funds were inadequate until the 1961 Congress authorized, under the Wetlands Loan Act, a fund of \$105 million repayable from receipts of the future sales of Duck Stamps. Thus, the accelerated wetlands habitat preservation program began.

The program has two parts. The land acquisition program protects the larger, more permanent wetlands. In Minnesota, about 1,000 of these nucleus waterfowl brood areas will be in public ownership. Under the second part of the program, the smaller, temporary wetlands around the nucleus areas will remain in private ownership but will be protected by easement under which the owner agrees, for a single payment, not to drain, burn, fill or level his wetlands.

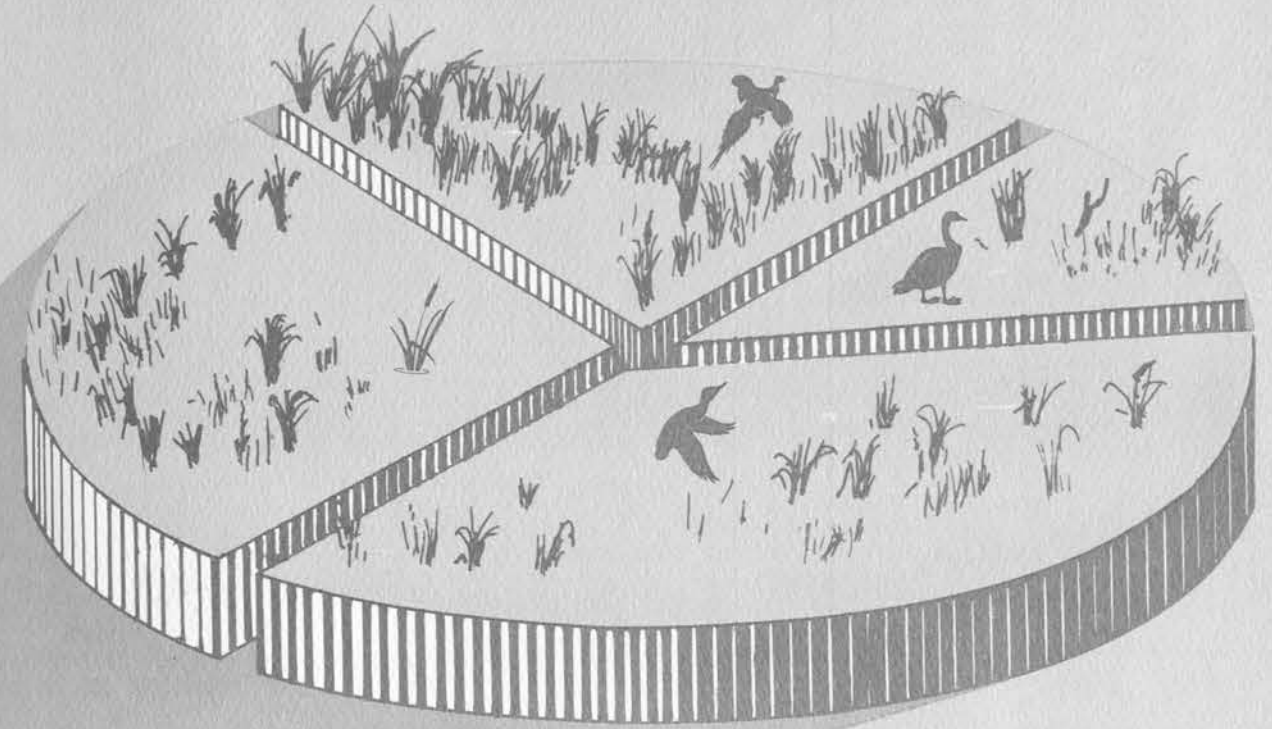
Although the federal wetlands program combined with the State of Minnesota acquisition program will give permanent protection to many wetlands, this is not the total answer. Continued public interest in and support for wetlands preservation is necessary.



MINNESOTA'S *Prairie Pothole Country*



WETLANDS PRESERVED FOREVER THROUGH
FEDERAL, STATE AND PRIVATE EFFORTS



-  Privately-owned wetlands
-  Wetlands preserved by state ownership
-  Wetlands preserved by federal ownership
-  Privately-owned wetlands preserved by federal easement

Of the important waterfowl producing prairie wetland acreage in Minnesota, it is planned that 10 percent will be preserved by federal ownership, 25 percent by state ownership and 40 percent by a permanent easement agreement with private owners. The preservation of the remaining wetlands must be the responsibility of the citizenry.



OBJECTIVES

The goal of the national wildlife refuge system is to further a national program of fish and wildlife conservation by restoring, developing and managing habitat for migratory birds and other species of fish and wildlife. To accomplish this, the Bureau of Sport Fisheries and Wildlife will make full use of the refuge system's fish, wildlife, land and water resources.

An integral part of the national wildlife refuge system, the Minnesota waterfowl production areas will support the following objectives:

Preserve privately-owned wetlands through payments to their owners for their agreement not to burn, drain, fill or level these wetlands.

Provide, through preservation of these tracts, a base for coordinating local watershed and land use planning.

Public Waterfowl Production Areas Will:

Provide the most favorable conditions for duck production as is economically and biologically feasible.

Provide a controllable area of land as a basic nucleus for natural resource planning by public and private organizations.

Be developed and managed for unique and threatened plants and animals.

Be dedicated to better public understanding and appreciation of fish and wildlife conservation.

Be developed and managed for nature-oriented recreational opportunity.

Provide hunting opportunity for waterfowl, upland and big game.

Provide habitat for a variety of migratory birds and other wildlife.

Preserve and enhance natural beauty for its scenic and other esthetic values.

Preserve representative segments of unique habitat.

*waterfowl hunting is a major benefit
of the wetlands preservation program*



WILDLIFE

on publicly-owned waterfowl production areas

Public waterfowl production areas will be managed to provide the best possible conditions for wildlife, particularly waterfowl. The areas will be popular to persons interested in hunting, bird watching and sightseeing, because of the great variety of land and water birds and other wildlife present on these wetlands.

*blue-winged teal are the most common
nesting ducks on Minnesota wetlands*





*waterfowl
broods need
food, water
and cover*

Waterfowl

The most common ducks nesting on the publicly-owned waterfowl production areas will be blue-winged teal and mallards. These species are high in demand and usually rank in the top five of the hunters' bag in the Mississippi Flyway. It will be our primary goal to provide duck production habitat for these species. Food, water and cover also will be provided for migrant waterfowl.

Other Birds

Marsh and water birds will be common residents. These are birds which provide many hours of enjoyment to the nature lover. Management of the marsh areas for waterfowl will improve conditions for these species.

Sharp-tailed grouse, ruffed grouse, and pheasants will also be found on the publicly-owned areas. The planting of food patches and re-establishment of native grasses are practices which will benefit upland birds. The increased game populations will provide greater opportunity for observation by the public and better days afield for hunters.

Another objective is to develop and manage these lands to help such threatened birds as the prairie chicken. The welfare of such endangered birds should be a matter of national conscience and the waterfowl production areas can assist in their survival by providing needed habitat.

*other birds utilize
waterfowl production areas*



*prairie wetlands
often provide
the only cover
for white-tailed
deer*



Mammals

White-tailed deer, common to the prairies, frequently will be found on waterfowl production areas. In the prairie pothole country, deer make heavy use of wetlands areas year around, providing an added bonus to the wildlife observer and the hunter.

The public will be able to enjoy squirrels, rabbits and other furbearing animals in their natural surroundings. Muskrats will generally improve waterfowl habitat, as will beavers, but both require control when they damage dikes and other water control facilities. Other furbearers are raccoon, weasel, skunk, fox and badger. Public harvest of these species in accordance with state law may be permitted.

*furbearers,
common to the
wetlands,
provide both
recreation
and income
to the public*



RECREATION

on publicly-owned waterfowl production areas

The publicly-owned waterfowl production areas in Minnesota will have much to offer in the way of waterfowl, marsh and water birds, a variety of wildlife and interesting wild lands. For public enjoyment and understanding of these resources wildlife management demonstration areas will be established in each of the counties where production areas exist.

With careful planning, the demonstration areas can provide nature-oriented public use without impairing the production of waterfowl. On non-demonstration areas, recreational facilities will be limited with the natural capabilities of the areas providing the recreational opportunity.

Picnicking

Picnicking can be part of a day's visit to waterfowl production areas. Picnic areas will be developed on the demonstration areas for group or family picnics. Picnicking will be welcomed on other areas, but no facilities will be provided.

*wetlands and wildlife can be
enjoyed by the entire family*





*wetlands are
wild places
where youth
can make
discoveries*

Nature Interpretation

Wildlife management demonstration areas will be developed to stimulate an appreciation and understanding of nature by persons of all age groups. This will be done by developing nature trails and interpretive signs and displays where visitors can view and understand the living wetlands community they are visiting. Educational techniques also will be used to show the role management plays in the preservation of such areas.

Sightseeing, Nature Study and Photography

The wildlife using these demonstration areas and the native plants present on them will attract many visitors. To assist the visitors in enjoying these areas, observation towers, photography blinds and trails will be constructed, enabling them to observe and study plants and animals in their natural environment.

*wetlands are outdoor
classrooms for students*



Waterfowl Hunting

Publicly-owned waterfowl production areas will help fill a need where public hunting areas are in demand. They will distribute waterfowl so that a larger number of people can enjoy the sport of wildfowling. The success of a hunting program will depend upon the attractiveness of the areas to waterfowl.

Upland and Big Game Hunting

Although the areas will be managed primarily for waterfowl, other wildlife species will also benefit. Pheasants will increase with development and should be utilized by the public through quality hunting programs. In addition to pheasants, ruffed grouse, rabbits, squirrels and white-tailed deer may be hunted during established state seasons.



*purchased
waterfowl
production
areas offer
anticipation
of hunting
action*

LAND AND WATER RESOURCES

on publicly-owned waterfowl production areas

Marsh and Water

Natural water areas will be supplemented by constructing small check dams on existing drainage-ways to create additional water areas, filling existing drainage ditches to restore drained wetlands, and blasting or bulldozing pot-holes.

These areas will provide additional sites for waterfowl breeding, brood waters and migration rest and feeding areas.

Uplands

Lands under cultivation at the time of acquisition usually will be seeded to a permanent grass cover to provide adequate nesting cover to waterfowl and other game as well as to prevent wind and water erosion. Some small patches of cropland will be maintained to furnish foods to upland game birds and other wildlife. Wooded areas will be maintained to provide for a balanced wildlife community.

Fencing of upland areas will be required to provide adequate protection and to utilize cattle grazing as a management tool in grassland areas. Control of noxious weeds may also be necessary.

*establishing
adequate cover
will be a
development
project*



BENEFITS

of publicly-owned waterfowl production areas

Development and management of publicly-owned waterfowl production areas will contribute to the conservation of the national migratory bird resource, afford more public enjoyment of waterfowl and other wildlife, and stimulate the local economy. Management will return both tangible and intangible benefits to the state and its economy.

Hunting opportunities for waterfowl, upland and big game will be offered.

Hunter success on private lands will improve as a result of wildlife populations on waterfowl production areas.

Visitors to publicly-owned waterfowl production areas will spend about \$500,000 in the state each year.

An estimated total development cost of \$3,500,000 will be spent locally for labor, equipment and materials.

Annual operations and maintenance costs amounting to about \$200,000 will be spent locally for supplies, salaries, equipment and materials.

*wetlands contribute indirectly to
the local economy in many ways*



ESTIMATED DEVELOPMENT COST

of publicly-owned waterfowl production areas

The following is a breakdown of the estimated cost of developments needed for the proper protection, management and recreational use of 1,000 waterfowl production areas purchased by the federal government.

The installation of these developments will be phased over a 15-year period beginning as soon as possible.

Water facilities	\$ 500,000
Biological development	600,000
Fencing	1,750,000
Posting	250,000
Recreation	400,000
	\$3,500,000

*fencing is
generally a
must for
adequate
protection*





Created in 1849, the Department of the Interior--America's Department of Natural Resources--is concerned with the management, conservation, and development of the Nation's water, fish, wildlife, mineral, forest, and park and recreational resources. It also has major responsibilities for Indian and Territorial affairs.



As the Nation's principal conservation agency, the Department works to assure that nonrenewable resources are developed and used wisely, that park and recreational resources are conserved for the future, and that renewable resources make their full contribution to the progress, prosperity, and security of the United States--now and in the future.



"For centuries Americans have drawn strength and inspiration from the beauty of our country. It would be a neglectful generation indeed, indifferent alike to the judgement of history and the command of principle, which failed to preserve and extend such a heritage for its descendants."

Lyndon B. Johnson





ACTIVITY
PLANNING
FOR
WILD
ENVIRONMENTS





THE CONCEPT

Planning for man's recreational activities in nature is critical to the future of wild environments, whether on national wildlife refuges, parks and forests or on state, county, city and private lands. The soaring demand for leisure-time activity space is imposing a responsibility on all retainers and users of these lands to think in terms of long-range recreation potentials and quality.

To insure the highest quality outdoor experience, the use of the landscape for outdoor recreation must be coordinated with nature. Often overlooked yet basic to this coordination are the principles of ecology. Applying ecology to planning for man in nature yields a product that reflects the total environment and the influences and interrelationships of its subsystems.

Because of the many relationships involved, environmental planning demands an interdisciplinary approach. The Bureau of Sports Fisheries and Wildlife has recognized these contemporary needs and has organized the National Planning Team. The Team, a blending of diverse professional talents, works with the greatest possible freedom from restraint and outmoded traditions.

Experienced in area master planning and in site planning, the team members weave facility design into the landscape while interpreting the environment for visitors. They work within a sphere of ecological knowledge and respect for the environmental makeup of an area.

THE APPROACH

In the first phase of a plan, the Team analyzes the proposed project during a meeting with the client and a preliminary field reconnaissance. The team members define the functional requirements and environmental framework of the area and determine the scope of the work to be performed. The Team then presents to the client its initial recommendations, including an outline of activity potentials, proposed planning services and a planning time schedule.

With the consent of the client, a project planning group is formed to begin the second phase of the plan. This group, which includes the client and any additional specialists needed, meets to establish the planning criteria and to develop the conceptual design. At prearranged stages throughout the project, the client formally reviews and approves all work to date. The completed plan is a guide for man's long-range, compatible use of a wild environment.

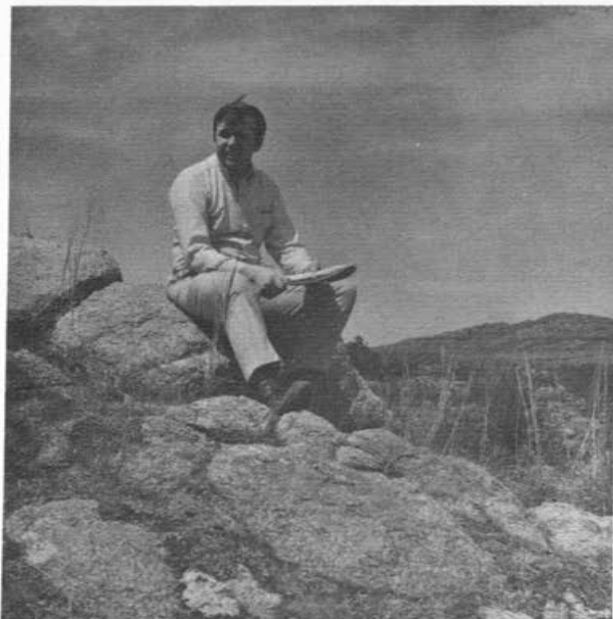
THE ORGANIZATION

The permanent core or nucleus of the National Planning Team is composed of a Wildlife Manager, an Architect, an Interpretive Designer, a Writer-Editor and an Administrative Assistant. The team also draws on other Bureau experts and retains consultants when appropriate.

Brief resumes of the team members follow:

Edward S. Crozier

Wildlife Planner



Bachelor of Science in Wildlife Management,
South Dakota State University.

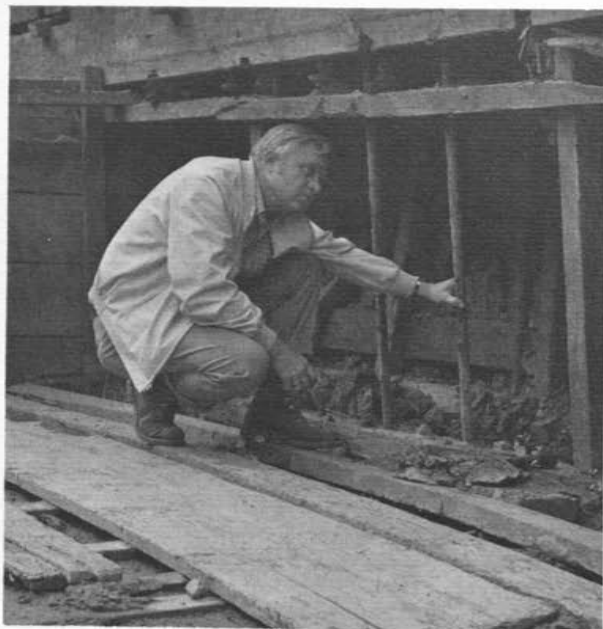
Field experience with the National Park Service, U.S. Forest Service and as a wilderness guide in the private sector of recreation. Seven years with the Bureau of Sport Fisheries and Wildlife managing national wildlife refuges in Wisconsin, North Dakota, Illinois and Iowa.

Three years as Regional Planning Team Leader, master planning wildlife areas. Two years as wildlife manager and team leader of a group planning wildlife areas on a nation-wide basis.



Joseph E. Knecht

Architectural Planner



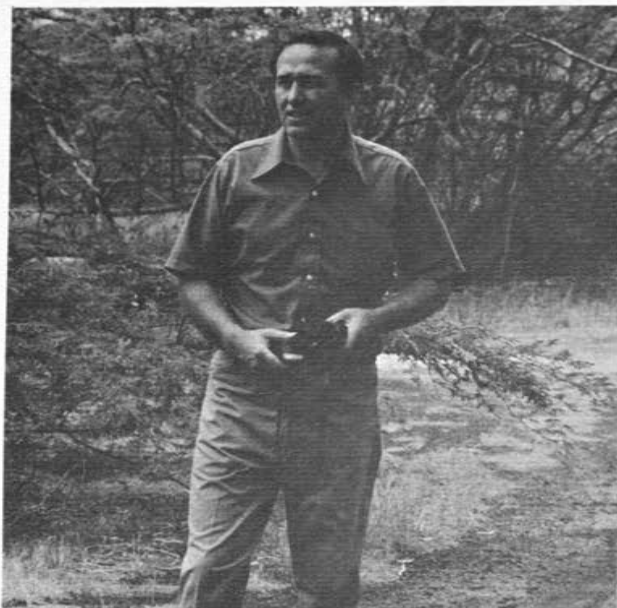
Attended the School of Architecture, University of Illinois, and Olivet College.

Six years with private architectural firms and twelve years as staff architect for the State of Wisconsin. Planned and designed facilities for Wisconsin's "Youth Conservation Camps," a pioneer youth program. Five years with the North Central Region of the Bureau of Sport Fisheries and Wildlife as a member of the Regional and National Planning Teams planning and designing structures, areas and programs associated with wild environments.



Charles J. Johnston

Interpretive-Designer



Bachelor of Fine Arts Degree from
the Minneapolis School of Art.

Has experience with the Bureau of Fisheries,
Minnesota Department of Conservation,
as Assistant Fish Culturist. Worked as an
artist for an advertising agency.

Nine years at the Science Museum, St. Paul,
as Chief Curator of Exhibits and Design.
Two years with the Bureau of Sport Fisheries
and Wildlife planning team designing
interpretive media. Free lance illustrating
for Harper-Row Book Publishers and various
natural history magazines.



Elaine B. Rhode

Environmental Communicator



Bachelor of Arts Degree in Journalism and one year of Masters study in Conservation at the University of Wisconsin.

Two summers and three years part-time on newspapers as reporter and editor. Field experience in geology, also in backpacking, cross-country skiing, canoeing and wildlife observation.

Assisted university team with interpretive prospectus for the National Park Service. Teaching Assistant for a university course in environmental resource management. Writer of interpretive trail signs and public use materials for the Bureau of Sport Fisheries and Wildlife.



Glenda K. Bargfrede

Administrative Assistant



Graduated from Mankato Commercial College.

Four years with the Internal Revenue Service, St. Paul. Two years Personnel Clerk with the Department of Navy, Rhode Island.

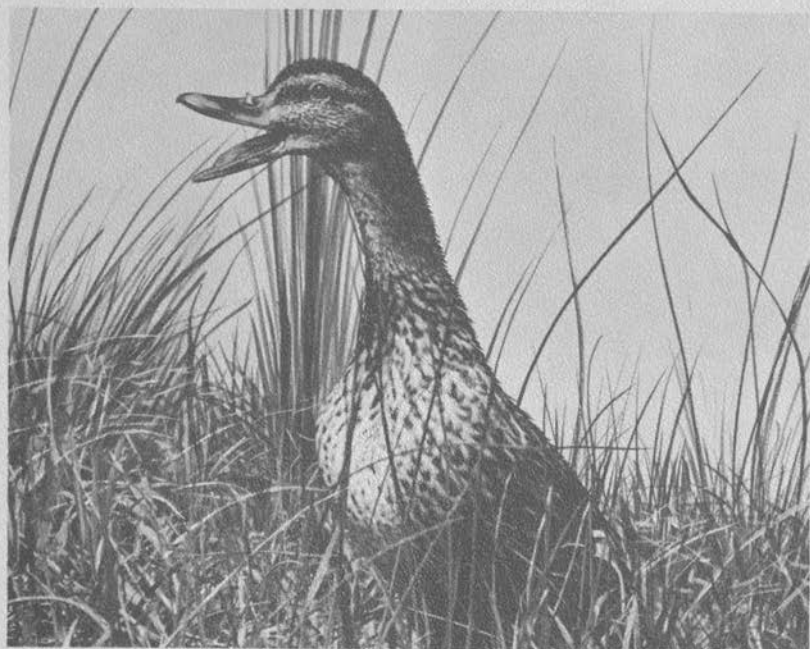
Two years in the North Central Region of the Bureau of Sport Fisheries and Wildlife in the Division of Personnel.

Carries out the fiscal, property, administrative and office management responsibilities as a member of the Bureau's National Planning Team.



BSF&W
Ft. Snelling Fed. Bldg.
Twin Cities, Minn. 55111

Native Sandhills Grasses



This grass display was established by the Bureau of Sport Fisheries and Wildlife in observance of the 1967 Nebraska Centennial, and will be maintained in future years for your education and enjoyment. The species shown here are among the more important of the native grasses which have contributed to the settlement and development of Nebraska. They are all common in the 12 million acre Nebraska Sandhills — the largest undivided expanse of grasslands in the United States.

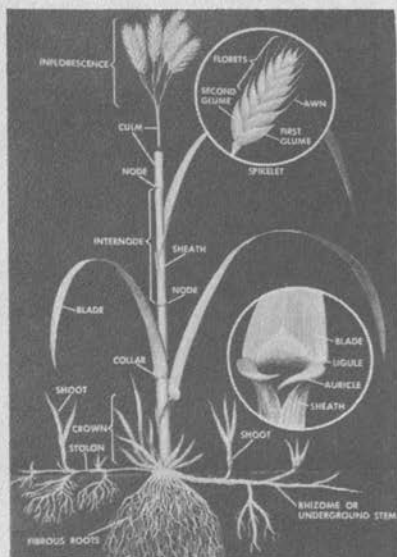
These grasses are valuable natural resources and a slight knowledge of them brings added pleasure and interest. As in most things, a deeper appreciation develops with knowledge and understanding. This is especially true concerning grass, so we hope this leaflet will make the grasses more meaningful to you.

**Valentine National Wildlife Refuge
Cherry County, Nebraska**

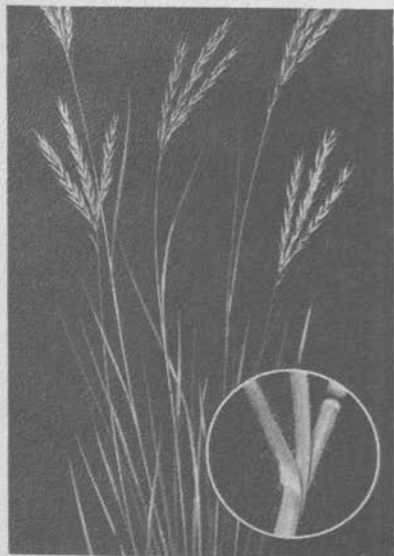
A GRASS PLANT showing principal parts

Grass has fibrous roots that take in water and nutrients and anchor the plant firmly to the ground. It spreads by seed, rhizomes, and stolons or runners. Leaves originate at the nodes and alternate on each side of the stem. They are parallel-veined, and composed of 3 parts—blade, sheath, and ligule. The sheath surrounds the stem like a split tube, protecting the new growth just above the node and supporting the thin stem. Ligule, meaning "little tongue", is sometimes called "a rainguard" and usually clasps the stem firmly which prevents dirt and water from fouling the sheath.

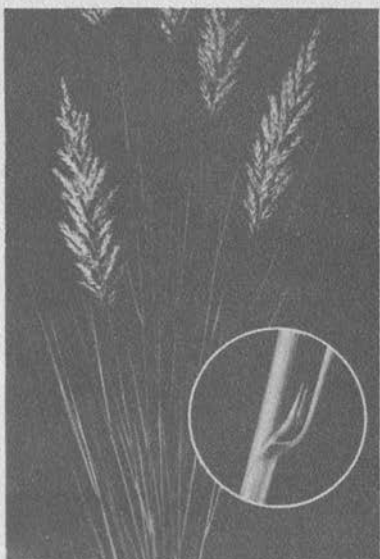
The culm or stem is usually hollow except at the nodes or joints. As a rule, flowers are perfect, containing both male and female parts.



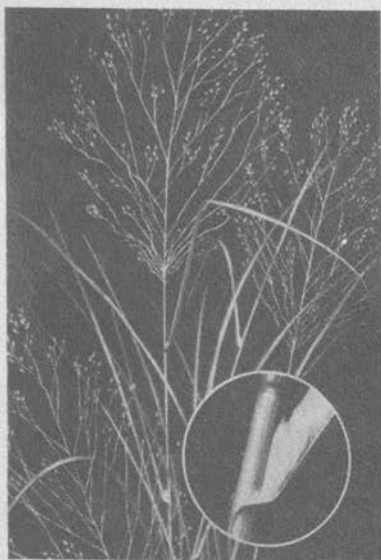
BIG BLUESTEM—A tall, warm-season grass which grows on moist, well-drained sites. An important grass in the extensive valleys of the Sandhills, it produces excellent quality forage either as hay or pasture. It furnishes nesting cover for waterfowl and upland gamebirds in addition to producing seeds for songbird food. This grass, like the other native tall grasses, will disappear when subjected to continuous close grazing. Important identifying characteristics are the large, reddish leaf blades which are markedly constricted at the base, and the reddish, "turkey-foot" type seed heads.



INDIANGRASS—A tall, warm-season grass best adapted to moist, well-drained soils. It produces excellent forage either as hay or pasture, and is an important grass of the sub-irrigated Sandhills valleys as well as excellent nesting cover for ducks and upland gamebirds. Aids in identification are the coarse leaves which have two prominent projections at the junction of the blade and sheath with a long projecting membrane between. In full bloom, the bronze seed heads make this one of our most beautiful native grasses.



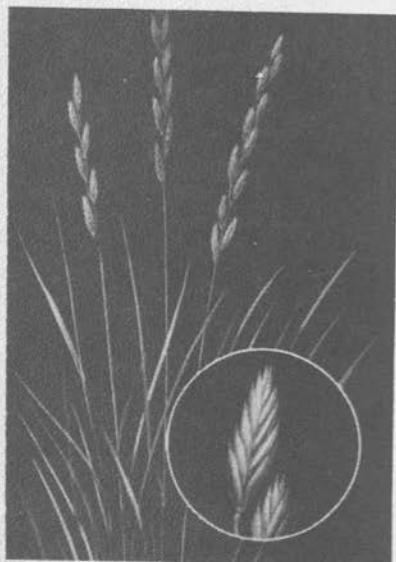
SWITCHGRASS — A stout, warm-season grass which grows best on sites where moisture is abundant. Although not as common or as palatable for hay as the bluestems, switchgrass occurs in Sandhills valleys and supplies excellent grazing. The plump seeds, produced in August or September, are relished by ground-feeding songbirds and gamebirds. Leaf blades of this grass are smooth on the upper side except for a dense pubescence near the junctions with stems. The plump seeds arranged in the branched, open seed heads are a good identifying characteristic.



LITTLE BLUESTEM—A medium-height, warm-season grass common on the drier, sandy upland sites in the Sandhills. It supplies good grazing in pastures if bunches do not become too old and stemmy. Clumps of this grass are excellent "snow-catchers" and also provide excellent wildlife cover. It can be identified by its "bunchgrass" growth form, the bluish-green, slender leaf blades which often develop a reddish tint and the compact, fuzzy seed heads.



WESTERN WHEATGRASS — A mid-height, cool-season grass which forms a heavy sod on wet sites. It is one of the most drought and alkali-resistant of the native grasses. Furnishes excellent forage as pasture with hay value classed as fair. The seeds are eaten by pheasants, grouse and songbirds; western wheatgrass also provides some forage for deer. The leaves are rough on the upper surface and often covered with a waxy coating. Two claw-like structures clasp the stem at the junction of the leaf blade and sheath.



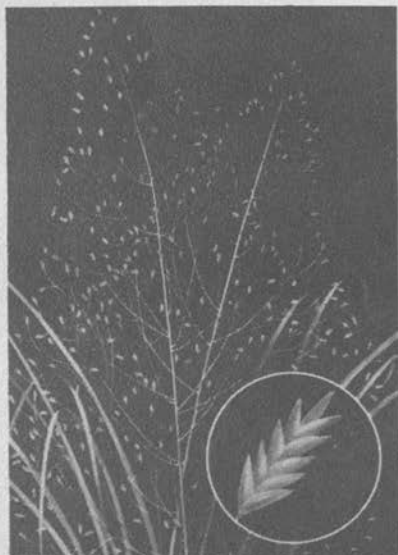
BLUE GRAMA — A short, warm-season grass which forms a light sod on dry hills and ridges of the Sandhills where it furnishes highly palatable livestock forage, both during the growing season and for winter grazing. Seeds are eaten by a variety of songbirds and the forage is taken by deer and antelope. Blue grama, along with buffalo grass, is most common in the short grass plains where both furnished a large portion of the early plains buffalo diet. The leaves are small and inconspicuous. The spikes or "flag-like" seed heads from 1 to 2 inches long are a good identifying characteristic.



BUFFALO GRASS — A short, spreading grass which reproduces by abundant, above-ground "runners" and forms a heavy sod. Although not too common in the Sandhills, it is one of the most important grasses in the short-grass prairie region. It withstands drouth and grazing well and cures out well to provide highly nutritious winter grazing. The principal wildlife value is as forage for antelope and buffalo; the seeds are eaten by a variety of prairie songbirds. Buffalo grass is typically dioecious, which means that the male and female flowers are borne on separate plants. The male spikes, usually less than 1/2 inch long, are the most conspicuous.



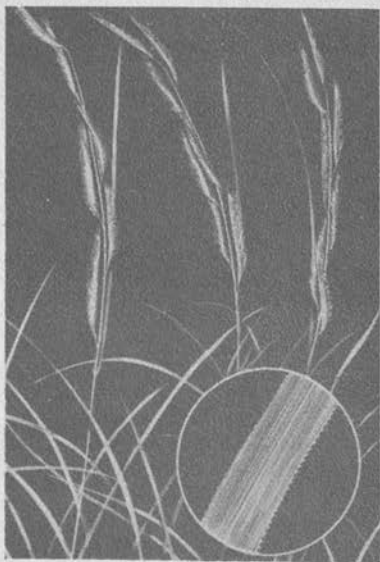
SAND LOVEGRASS — This erect, warm-season bunchgrass grows from 1 to 4 feet tall and is especially common in the Sandhills. The high quality forage produced by sand lovegrass is readily grazed by livestock. This grass furnishes nesting cover for ducks and upland gamebirds. The small seeds are eaten by a few songbirds. The large, open and finely branched seed heads are purplish to greyish in color and often make up about 1/2 of the total plant height.



SAND BLUESTEM — This erect, robust warm-season grass grows up to 6 feet tall. It is best adapted to sandy soils, particularly on dune sand slopes. Quality of forage produced is only fair but because of its abundance on steep slopes and its tendency to stabilize blow-outs, sand bluestem is a very important grass. This species is similar to big bluestem and intergrades of the two are often found. As a rule, the leaves of sand bluestem are much lighter and the seed heads are much more fuzzy.

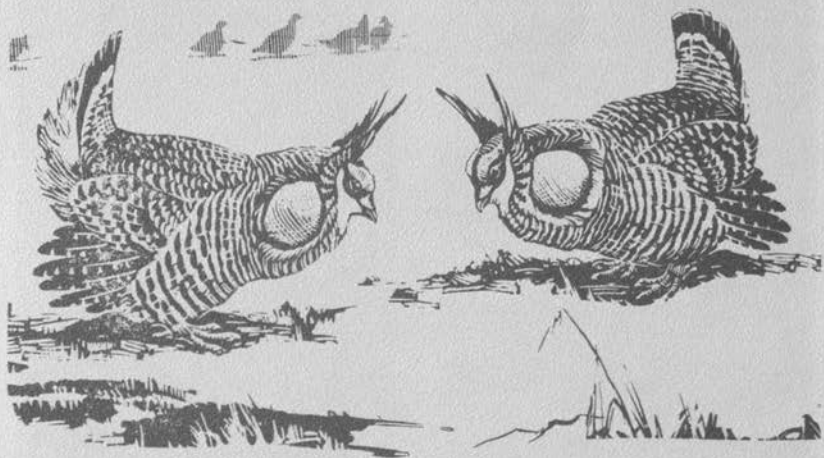


PRAIRIE CORDGRASS — This warm-season species grows in wet areas where the dense stands occasionally reach heights up to 8 feet. It spreads by coarse rhizomes and produces high yields of medium quality hay if cut before the seed heads appear. The primary wildlife value is the protective cover supplied to many species of marsh and water birds. A few species of birds feed on the seeds. The coarse, dark green leaves and the twisted seed heads suggesting cords are good identifying characteristics.



PRAIRIE SANDREED — This tall, warm-season grass spreads from vigorous, creeping rhizomes. It is well adapted to the drier, sandy soils and is a very important species in the Sandhills rangelands. Although forage value is only fair, this grass is important in terms of abundance. It is an excellent species for stabilizing Sandhills blowouts. The leaf blades are firm, long, flat or somewhat rolled and usually taper to a long, fine point. The strawcolored seeds occur in open but narrow seed heads.

PRAIRIE JUNEGRASS — This mid-height, cool-season grass begins growth in the early spring, usually forming seed heads by June and drying up by July. It is well adapted to dry hills and plains where it grows in small bunches. Not too important in terms of total forage produced, an important source of early grazing for both livestock and big game animals. Except when in bloom, the seed heads are contracted into cylindrical spikes which are light in color.



The Valentine National Wildlife Refuge contains approximately 60,000 acres of grassland upon which these and other species grow. These range-lands are being managed to provide the optimum habitat for nesting water-fowl and upland gamebirds. Grazing of livestock, using sound range management practices and special adaptations for the benefit of wildlife, is one of the primary management tools employed. Approximately 30 surrounding ranch families are benefited by the lease of controlled grazing privileges and annual revenue from the grazing program exceeds the total operational cost of the refuge.

A self-guided nature trail is provided one-fourth mile west of refuge headquarters for all desiring additional information of the native flora of the area.

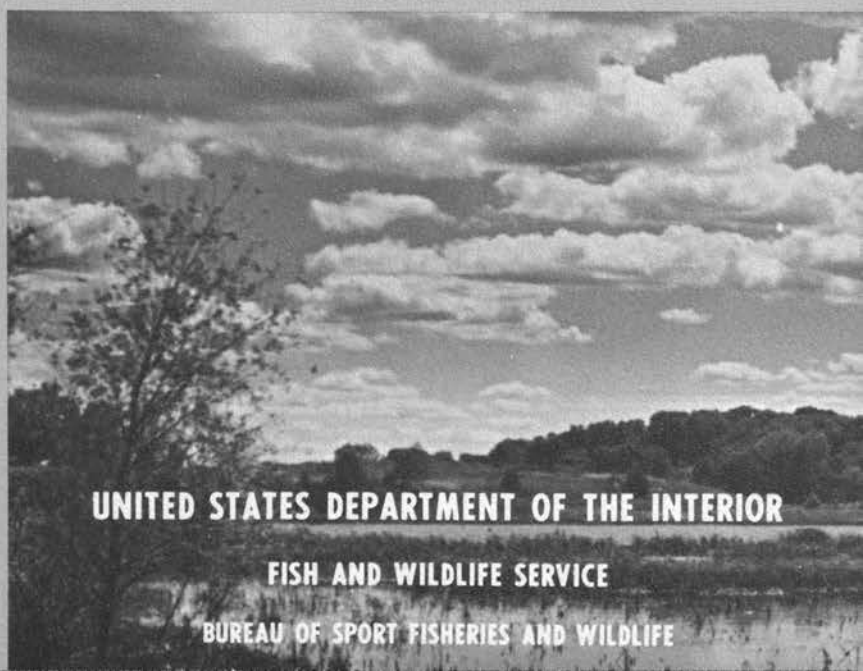


Created in 1849, the Department of the Interior—a department of natural resources—is concerned with the management, conservation, and development of the Nation's water, fish, wildlife, mineral, forest and park and recreational resources. It also has major responsibilities for Indian and Territorial affairs.

As the Nation's principal conservation agency, the Department works to assure that nonrenewable resources are developed and used wisely, that park and recreational resources are conserved for the future, and that renewable resources make their full contribution to the progress, prosperity, and security of the United States—now and in the future.

UNITED STATES DEPARTMENT OF THE INTERIOR
Fish and Wildlife Service
Bureau of Sport Fisheries and Wildlife

Sherburne NATIONAL WILDLIFE REFUGE



UNITED STATES DEPARTMENT OF THE INTERIOR

FISH AND WILDLIFE SERVICE

BUREAU OF SPORT FISHERIES AND WILDLIFE

*We and our children will be the losers if we do not care
enough to save from exploitation some hills and dunes
and swamps and woods and lakes where we can renew our
ties to Nature and where God's other creatures can live
and move and have their being.*

Stewart L. Udall - 1964
WATERFOWL TOMORROW



Sherburne **NATIONAL WILDLIFE REFUGE**

The locale of Sherburne National Wildlife Refuge, once known for its abundant wildlife, but now changed by man, has lost much of its original wildlife value. The development of Sherburne Refuge will restore many of these values.

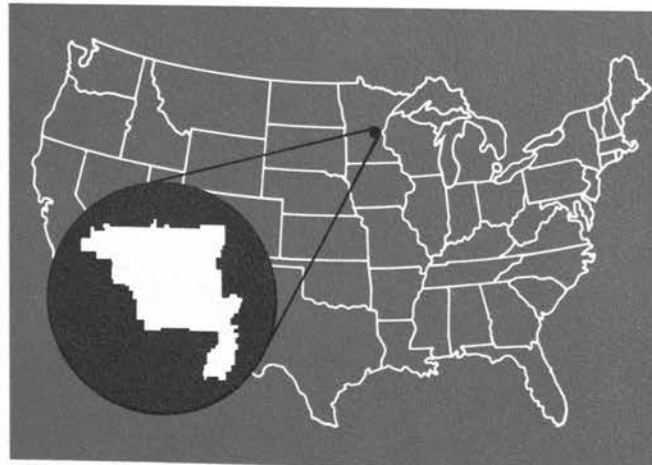
Approved for purchase by the Migratory Bird Commission on May 18, 1965, the refuge will ultimately comprise 31,000 acres. Legislation authorizing its establishment includes the Migratory Bird Treaty Act, the Migratory Bird Conservation Act and the Migratory Bird Hunting Stamp Act.

Refuge goals include producing at least 10,000 ducks and 500 geese annually; providing food, rest and protection to a fall population of 100,000 ducks and 25,000 geese; and providing nature-oriented recreation to the public.

This refuge, located within 40 miles of two million people, will provide excellent opportunities for people to observe wildlife in its natural setting and to become familiar with wildlife management programs and their part in the total conservation effort.

Developments planned include construction of a series of shallow impoundments for waterfowl, a visitor center, picnic areas, nature trails, boat access areas and operation and service facilities.

Estimated total development cost of Sherburne Refuge is \$4,000,000.





*the refuge will harbor large
concentrations of waterfowl*

THE LEGACY

When Father Hennepin, the explorer-priest, traveled south into the Sherburne area in 1680, he found the St. Francis River meandering through a mixture of prairie, forests and marshes, each of these zones supporting abundant wildlife. Elk roamed the prairies, while grouse, deer and bear inhabited the forests. Ducks, geese and their broods dotted the marshes which held wild rice, pondweeds and other aquatic plants.

White men arrived in the area in the mid-19th century after the Chippewas drove the Sioux from the forests out onto the plains. White men logged off the forests, broke the sod and seeded the thin top-soils to crops. These land use changes destroyed wildlife habitat and wild game populations declined.

As the demand for farmland grew, the river basins became laced with drainage ditches and marshes and meadows were put to the plow. In time, only the deep lakes and river channels held water for ducks and geese. Migration concentrations of waterfowl disappeared. Elk and bear remained only in the north where farming was impractical. In the refuge area, only vestige populations of deer and grouse could survive on the suitable habitat remaining. Generations succeeding the original settlers soon forgot the wildlife heritage which had been destroyed.



*the lands of
Sherburne County
were once
abounding with
wild game*

THE RENEWAL

Complete restoration of the former pristine life and beauty is no longer possible. However, we can greatly improve conditions for waterfowl to a degree where they equal or even surpass those of two or three centuries ago.

Local sportsmen's clubs and wildlife conservation organizations became interested in reviving the St. Francis marshes in the early 1940's. After World War II, these groups solicited assistance from the Minnesota Department of Conservation. Surveys and studies by the State showed that a restoration project was feasible but beyond the financial means of the State. In early 1961, the State recommended the project to the Bureau of Sport Fisheries and Wildlife for consideration.

*the refuge will provide excellent
white-tailed deer habitat*





refuge waters will provide optimum conditions for production of diving ducks, including canvasbacks

Recognizing that the area has basic characteristics necessary for a national wildlife refuge of major importance, the Bureau soon proposed acquisition and development of the area.

When developed, the area will produce thousands of waterfowl and host large populations of migrating birds during the spring and fall. Resident game species such as deer and grouse will benefit.

Significantly, the public will benefit directly and substantially from the refuge. Public hunting of waterfowl, upland game and big game, fishing, picnicking, canoeing and other recreational activities will be included in the refuge management programs. These forms of recreation and the chance to view wildlife in its natural habitat will provide worthwhile and meaningful leisure activities for thousands of people.



*school groups will be
enlightened by the
interpretation program*

OBJECTIVES

The goal of the national wildlife refuge system is to further the development of a national program of fish and wildlife conservation by restoring, developing and managing land and habitat for migratory birds and other species of fish and wildlife for the maximum production, perpetuation, utilization and public enjoyment inherent in the fish, wildlife, land and water resources of the system.

Sherburne Refuge, as an integral part of this system, will support the following objectives:

Provide favorable conditions for duck and Canada goose production as is economically and biologically feasible.

Dedicate the lands to the better public understanding and appreciation of fish and wildlife conservation by supporting and encouraging nature-oriented conservation education programs.

Restore habitat and provide additional habitat through management programs.

Provide public hunting opportunities on refuge lands consistent with other objectives.



ruffed grouse, like other upland game, will be provided food and cover throughout the year

Develop and manage habitat for a variety of migratory bird species that will provide public enjoyment.

Develop and manage habitat for unique and threatened species such as the bald eagle, prairie chicken and trumpeter swan.

Conserve and enhance, to the extent feasible, the natural beauty of the total refuge environment.

Develop and manage the refuge area for maximum nature-oriented recreational opportunities, as governed by law, policies and higher priorities.

Restore proper land use in accordance with soil capabilities and wildlife habitat.

Contribute to the local economy through programs of cooperative farming, fur harvest and timber harvest. Refuge visitors can be expected to contribute substantially to the area's economy by expenditures for goods and services.



leisure fishing in quiet waters will be a premium offered by the refuge

WILDLIFE MANAGEMENT

Sherburne Refuge will be restored and improved to replace, in part, wildlife habitat that has been lost and is being lost in east-central Minnesota through urban expansion, highway construction and agricultural drainage. The wildlife that will result will be the source of public enjoyment through nature-oriented recreation.

The refuge is located in relation to centers of human populations and adjacent wildlife habitat to provide a better opportunity for people to enjoy wildlife, especially waterfowl. The area will be extremely popular to persons interested in bird watching and to the sightseer because of the great variety of land and water birds and other wildlife that may be observed there.

Wildlife management goals relate the wildlife potential of the refuge to the anticipated needs of wildlife and the visiting public while serving as guidelines for development and management planning.

*the majestic swans will thrill
the refuge visitors*



Ducks

The most common ducks nesting on Sherburne Refuge will be mallards, wood ducks and blue-winged teal. These birds are species high in demand, as they usually rank in

the top five of the hunter's bag in the Mississippi Flyway. It will be a primary goal of the refuge to produce a minimum of 10,000 ducks annually.



MALLARDS

Another goal is to provide food, water and protection in the fall of the year to peak populations of 100,000 ducks. This migrant population will be primarily mallards, blue-winged teal, ring-necked ducks, wood ducks and scaup.

Canada Geese

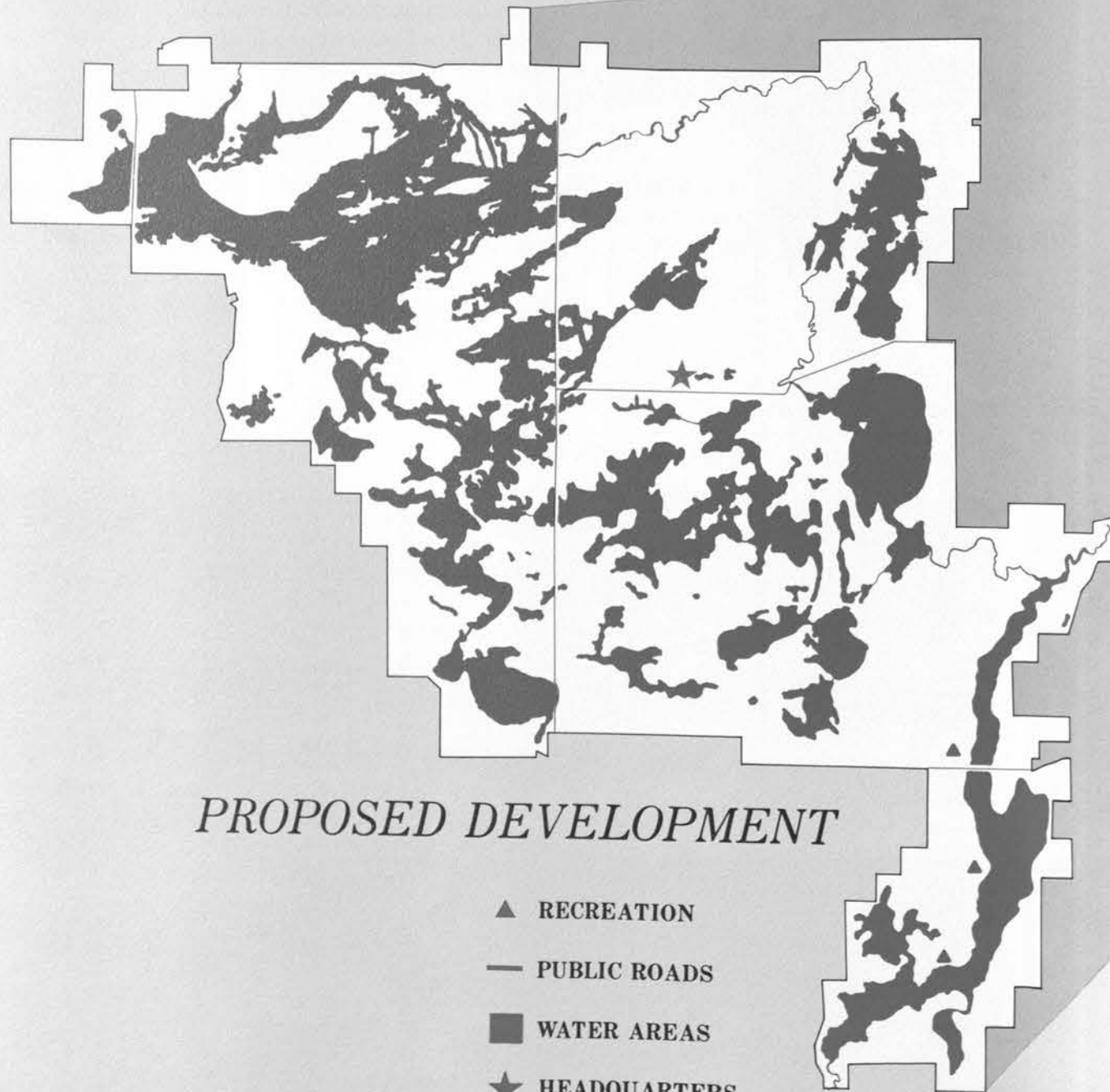
This trophy bird is in high demand by hunters and by persons interested in observing and photographing wildlife. Geese have esthetic appeal and serve as a stimulus for interest in wildlife management and conservation education.



CANADA GEESE

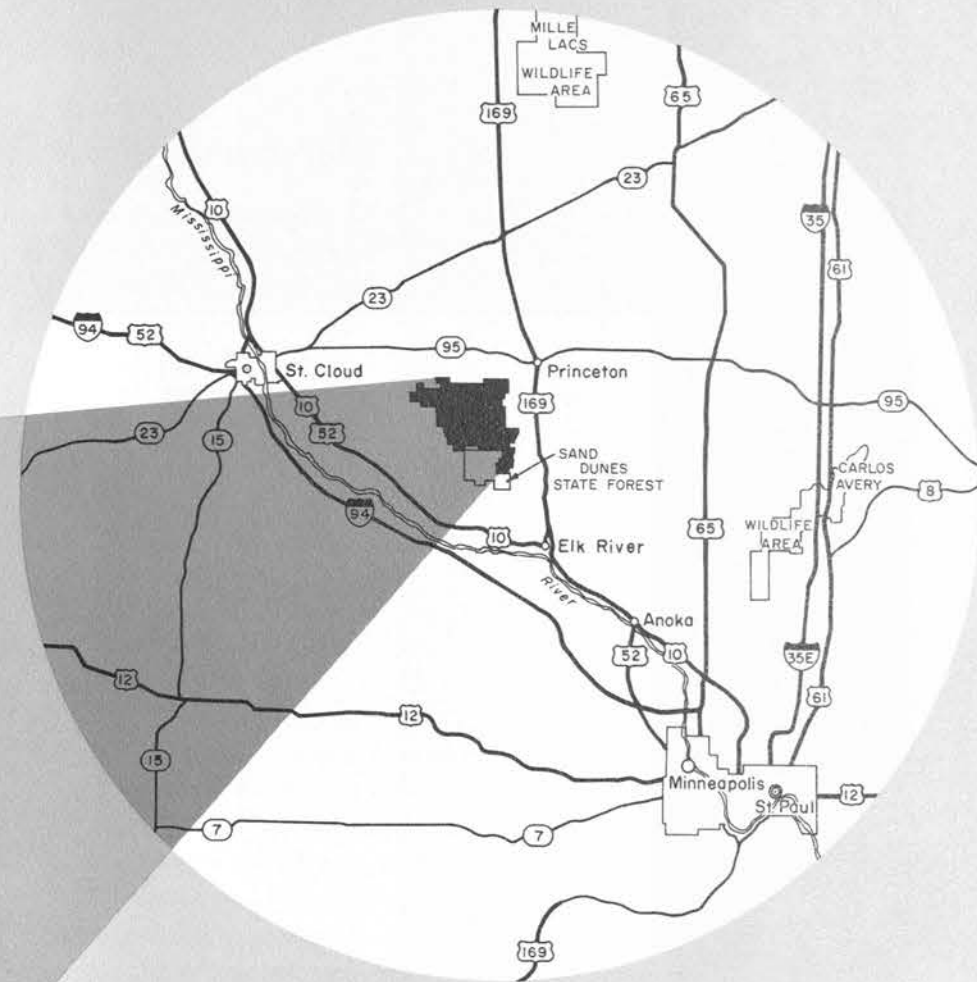
An important goal of the refuge is to provide suitable habitat for a breeding flock of Canada geese capable of producing 500 to 1,000 goslings annually. To provide hunting opportunity for this trophy bird in an area where the sport of goose shooting has virtually disappeared, the refuge will host a fall population of 25,000 Canada geese.

Sherburne NATIONAL WILDLIFE REFUGE



PROPOSED DEVELOPMENT

- ▲ RECREATION
- PUBLIC ROADS
- WATER AREAS
- ★ HEADQUARTERS





Marsh and Water Birds

Marsh and water birds including herons, cormorants, egrets and shore birds will be common residents. These are birds which will greatly interest the nature lover. Management of the marsh areas for waterfowl will enhance the refuge for these species.

Upland Game

Sharp-tailed grouse, ruffed grouse, pheasants, squirrels and rabbits will benefit from management practices on the refuge. Timber stand improvement, planting of food patches and re-establishment of native grasses are practices which will benefit upland game. The increased game populations will provide greater opportunity for observation by the visiting public and a greater harvest opportunity for hunters.



Big Game

White-tailed deer, common to the refuge, will increase in number as refuge management progresses. The herd will be healthier and a greater number of hunters will enjoy success.



Black bear may be seen on the refuge on rare occasions. No special management will be required for these animals.

Furbearers

Furbearer management will recognize their effect on waterfowl and the opportunity for the public to observe furbearers in their natural surroundings. Muskrats will generally improve waterfowl habitat, as will beavers, but both require control when they damage dikes and other water control facilities. Other furbearers found on the refuge are raccoon, weasel, skunk, fox, bobcat, and badger. Some of these are predators and will be controlled when necessary. Public harvest of these species in accordance with State law will be permitted as a management tool.



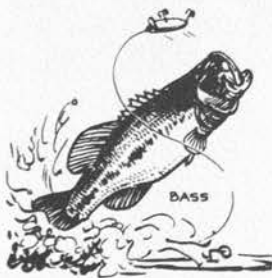
Unique Wildlife

An objective of the refuge is to provide for such rare birds as the bald eagle, prairie chicken and trumpeter swan. The welfare of these birds is of national concern and the refuge can assist in their survival by providing sanctuary and proper habitat. Prairie chickens and trumpeter swans will be introduced once their requirements, which are of a specialized nature, can be provided. Bald eagles will be provided protection and sanctuary.



Fish

The shallow waters of the refuge will provide excellent spawning areas for northern pike while the deeper areas will provide sport fishing opportunity for northern pike, walleyes, bass, bluegills, crappies and others. Management of the fishery resource will be a cooperative effort between the Minnesota Conservation Department and the Bureau.



RECREATION

Few spots in the Upper Midwest have factors more favorably aligned for nature-oriented public recreation. The refuge is located within 40 miles of at least 2,000,000 people and will have much to offer in the way of impressive waterfowl concentrations, variety of other wildlife, interesting wildlands and recreation facilities. The refuge, located adjacent to the Sand Dunes State Forest, will present recreational opportunity for as many as a half million people who will annually visit the refuge.

With careful planning, Sherburne Refuge can provide a substantial amount of nature-oriented public use without conflict with wildlife or damage to the environment.

*our youth must be provided areas where
they can renew their ties with nature*





*knowledge gained through conservation education
will enhance appreciation of wildlife*

Nature Interpretation

A visitor center, nature trails and interpretive devices will supplement the other refuge programs so that the public can learn and appreciate the unique role of the refuge in the overall effort to conserve our natural resources.

Various interpretive media will be used to explain the natural characteristics of the refuge and to stimulate people to learn and appreciate more of their natural heritage. The visitor center will house such interpretive media, as well as an auditorium where audio-visual programs will be presented to youth and adult groups. Conservation workshops and meetings will take place here. This conservation education facility will be the starting point for refuge nature trails, both foot and auto, and the focal point of the refuge's nature interpretation program.

Waterfowl Hunting

Sherburne Refuge will provide a place to hunt waterfowl in an area where hunting areas are in high demand. The extent to which refuge waterfowl hunting will be permitted will be measured by the response of the birds to the refuge management program.

Upland and Big Game Hunting

Although the refuge will be managed primarily for waterfowl, other wildlife species will also benefit. Species such as pheasants and deer will increase with development of the refuge and should be utilized by the public through high-quality hunting programs. Hunting opportunities will be offered during established state seasons and during periods when hunting activities are least damaging to the refuge's waterfowl program. Species that may be hunted are pheasants, ruffed grouse, rabbits, squirrels, foxes and white-tailed deer.

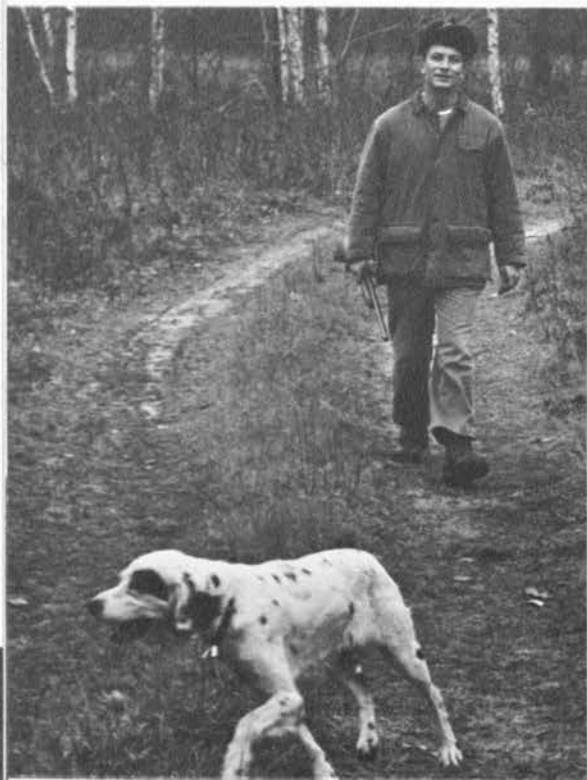
Fishing

Much of the refuge waters will be too shallow for sport fishing and will be located on waterfowl production areas where public disturbance must be controlled. However, the southeast portion of the refuge will have deeper pools where sport fishing will be encouraged. Boat launching facilities and access to fishing areas will be available.

Picnicking

Picnicking on the refuge will be part of a day's visit. Picnic areas will be developed on scenic sites beside water areas for group or family picnics.

*quality
hunting
will be
stressed
in refuge
hunting
programs*





*the opportunity to observe
waterfowl will be abundant*

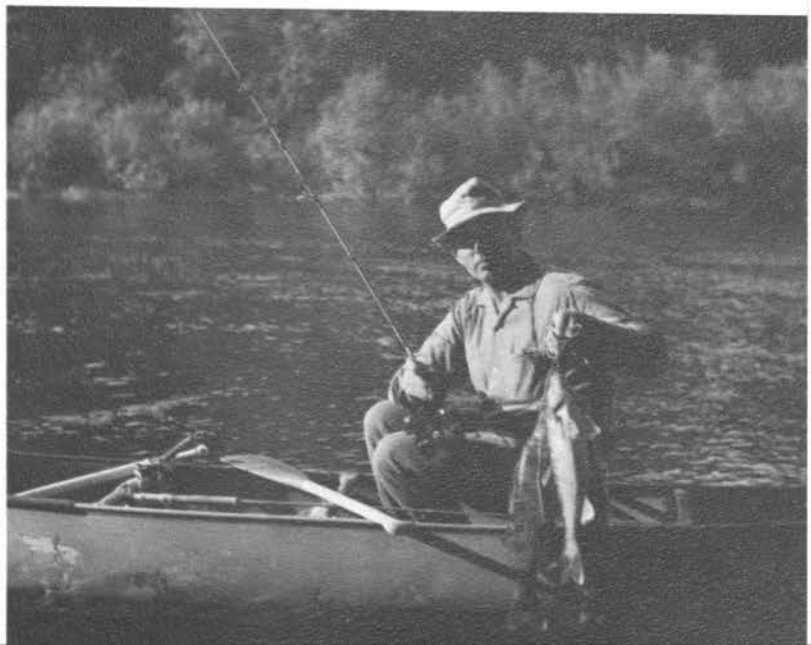
Sightseeing, Nature Study and Photography

Major public use of the refuge will be sightseeing. The refuge is close to the Twin Cities, one of the Upper Midwest's largest metropolitan areas. There will be excellent access via U. S. Highways 10, 52 and 169. Ducks, geese, other wildlife and various natural scenes will attract a large number of single-day visitors. Refuge roads open to the public will traverse waterfowl areas, giving the public an excellent opportunity to observe waterfowl as well as other marsh birds. Observation towers, photography blinds and nature trails will assist the visitor in enjoying representative sections of the refuge woodlands, waterfowl habitat, prairies, and other scenery areas and in observing and studying plants and animals in their natural surroundings.

Canoeing

During designated periods of the year, canoe trips through portions of the refuge will be encouraged. These trips will allow the public to get into the "back country" and become closer to nature.

*canoeing quietly through
refuge waters will bring
gratifying satisfaction*



LAND AND WATER RESOURCES

Marsh and Water

There is a potential for creating 40 impoundments totaling approximately 10,000 surface acres. These impoundments will be constructed along the St. Francis River and other natural drainageways. These areas, ranging in size from less than 100 acres to more than 1,000 acres will be managed to provide nesting and rearing habitat for ducks and geese and to produce a variety of waterfowl foods.

In addition to the proposed impoundments, there are hundreds of semi-permanent and permanent wetland areas. There is potential for improving these wetlands and creating more.

Uplands

Corrective measures will be taken to rebuild soils which lack basic plant nutrients and organic matter. On areas where top soils are thin and wind and water erosion a problem, permanent grass cover will be established.

Four thousand acres of land will be kept under cultivation to provide the main food supply for the 125,000 waterfowl expected to use the refuge in the fall. These acres also will furnish foods to upland game birds and animals.

Although croplands and wetlands furnish food and cover for wildlife, the 8,000 acres of forest lands also provide a very important segment of the habitat necessary for a balanced wildlife community. Refuge objectives for forest lands necessitate the harvest and thinning of tree plantations, planting trees in poorly stocked areas and replacement of undesirable species.

*marshes are
the lifeblood
of many forms
of wildlife*



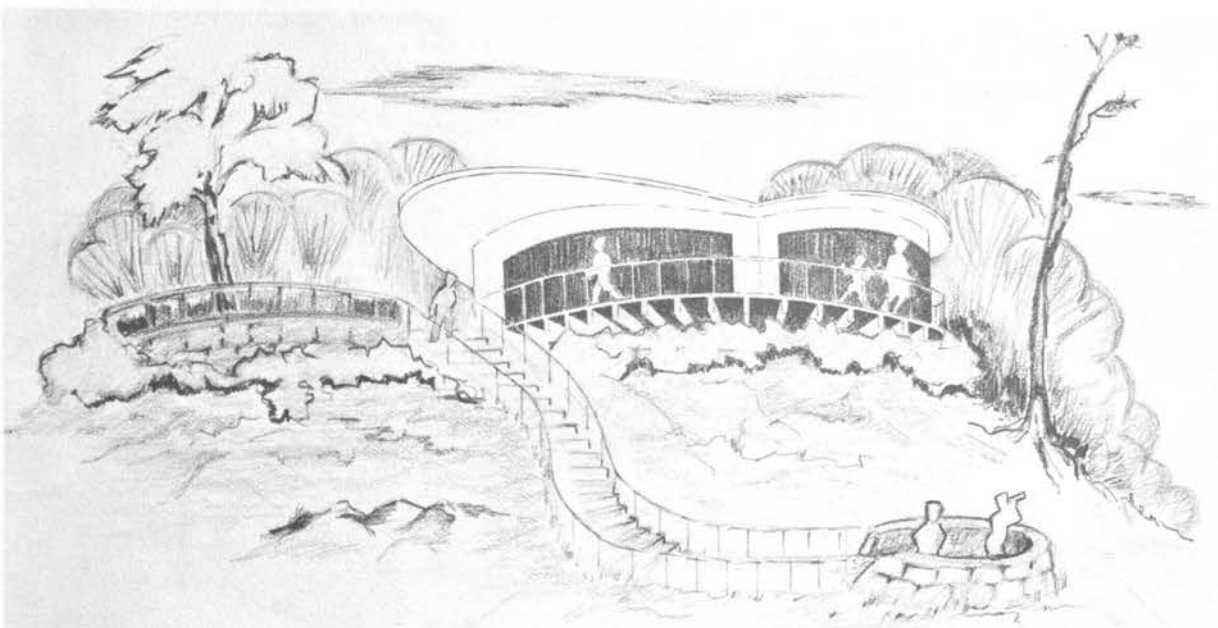
FACILITIES FOR OPERATION

The management of a national wildlife refuge involves manipulation of lands and water, maintenance of facilities, protection of the public and the refuge and the correlation of the recreational and wildlife programs. These activities necessitate the following developments on the Sherburne Refuge area:

Office building	44 miles of road
Service building	45 entrance and information signs
Residences	106 miles of posting
Equipment and storage buildings	94 miles of fencing

ESTIMATED DEVELOPMENT COST

Water facilities	\$1,800,000
Biological development	350,000
Buildings	380,000
Fencing and posting	100,000
Roads	660,000
Structures and utilities	60,000
Recreational development	650,000
Total	\$4,000,000



VISITOR CENTER CONCEPT

BENEFITS

Development and management of Sherburne Refuge will contribute to the conservation of the national migratory bird resource, afford an opportunity for public enjoyment of waterfowl and other wildlife in its natural environment and enhance the local economy. Management of the refuge will provide both tangible and intangible benefits to the community, the state and the nation.

Hunting opportunities for waterfowl, upland and big game will be offered on the refuge.

Hunter success on private lands will improve as a result of wildlife populations on the refuge.

Estimated annual expenditures made in the local area of the refuge by refuge visitors will be \$500,000.

A substantial portion of the estimated development cost of \$4,000,000 will be expended locally for labor, equipment and materials.

Annual operations and maintenance costs amounting to approximately \$200,000 will be expended locally for supplies, salaries, equipment and materials.

The refuge cooperative farming program will yield an estimated \$100,000 annually in gross receipts to local farmers. The purchase of fertilizer, seed, equipment and labor necessary for the farming program will contribute additional money to the local economy.

September 1966



Created in 1849, the Department of the Interior-- America's Department of Natural Resources--is concerned with the management, conservation, and development of the Nation's water, fish, wildlife, mineral, forest, and park and recreational resources. It also has major responsibilities for Indian and Territorial affairs.



As the Nation's principal conservation agency, the Department works to assure that nonrenewable resources are developed and used wisely, that park and recreational resources are conserved for the future, and that renewable resources make their full contribution to the progress, prosperity, and security of the United States-- now and in the future.



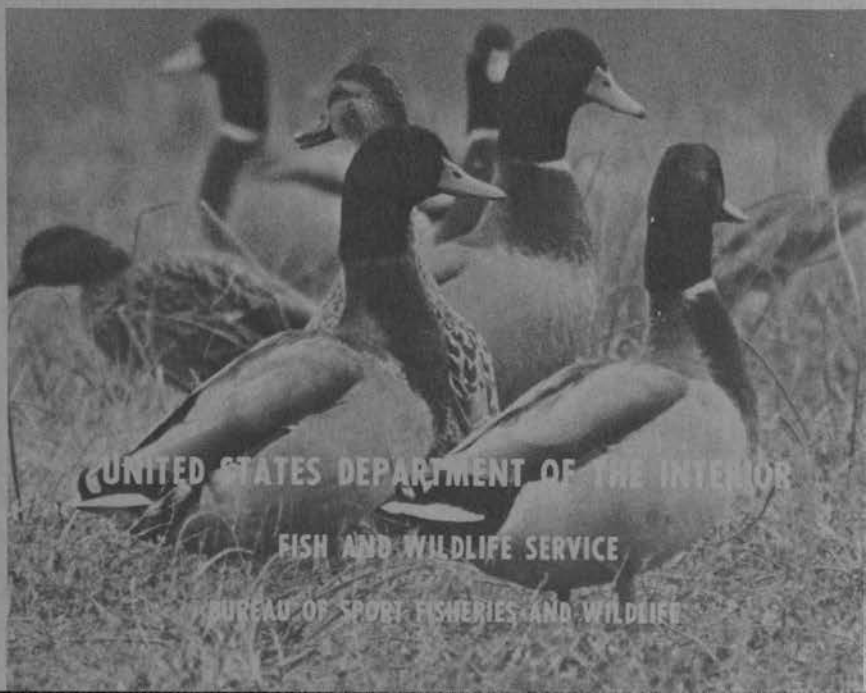


For centuries Americans have drawn strength and inspiration from the beauty of our country. It would be a neglectful generation indeed, indifferent alike to the judgement of history and the command of principle, which failed to preserve and extend such a heritage for its descendents.

Lyndon B. Johnson

Chautauqua NATIONAL WILDLIFE REFUGE

ILLINOIS



UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE



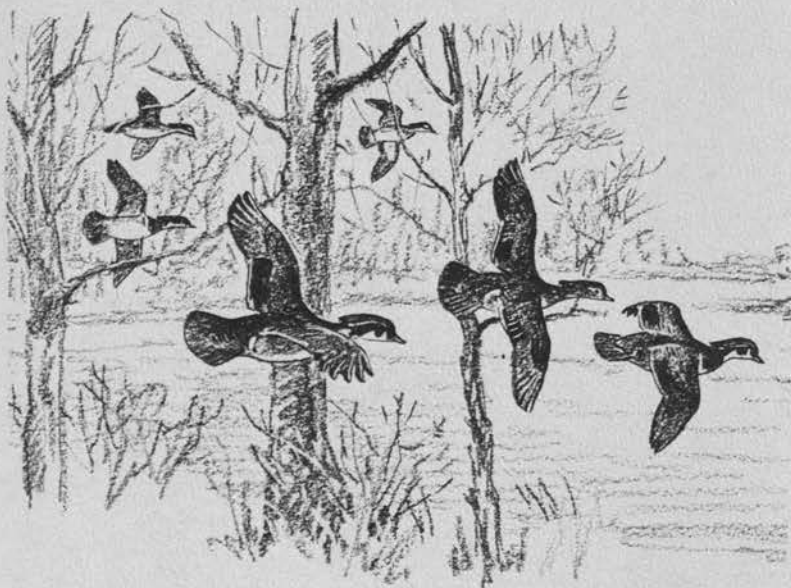
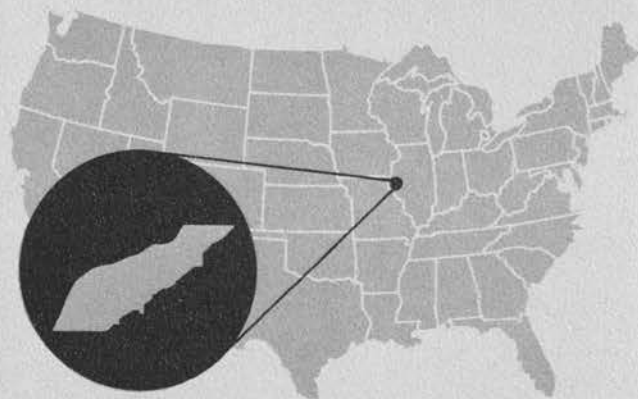
Lake Chautauqua – 1939

This booklet describes Chautauqua National Wildlife Refuge, the basic problems confronting it, an analysis of development proposals and the plan for the future.



Lake Chautauqua – 1967

Chautauqua NATIONAL WILDLIFE REFUGE



THE ESTABLISHMENT

Locale of Chautauqua National Wildlife Refuge is the Illinois River Valley, historically known for its wildlife. The refuge was established to preserve a portion of this valuable river bottom habitat, especially for waterfowl.

The refuge was authorized for purchase by Executive Order 7524 dated December 23, 1936 and in that same year, the U. S. Biological Survey initiated purchase of the former Chautauqua Drainage and Levee District. Today the refuge encompasses 4,487 acres of land and water with 3,700 acre Lake Chautauqua as the dominant feature.

Much of the early refuge construction was done through Public Works Programs





Providing for mallards during migration is a primary goal

THE OBJECTIVES

Goal of the national wildlife refuge system is to further a national program of fish and wildlife conservation by restoring, developing and managing the environment for these wild creatures. All of the natural resources of this refuge will be managed to accomplish this objective.

As part of this great national effort, Chautauqua National Wildlife Refuge will support the following objectives:

Provide as near optimum conditions for migrating waterfowl use and wood duck production as is economically feasible.

Manage refuge land, water, flora and fauna to provide an educational experience to visitors and to stimulate an appreciation of the wildlife resource and its associated ecology.

Provide such nature oriented recreation as hunting, sport fishing and picnicking.

REFUGE DESCRIPTION

Water

The Chautauqua Drainage and Levee District, organized in 1916, was one of many drainage districts established in the early 1900's which diked and drained 200,000 acres of Illinois River bottomlands for agriculture.

The District was active until 1926 when the protecting levee broke and the pumping station was nearly destroyed. The damage was so extensive that the District was abandoned. For about ten years the water in the flooded district fluctuated with the Illinois River as a backwater area. The area became known as Lake Chautauqua and abounded with aquatic plant life attractive to both fish and waterfowl.

Several years after the United States acquired the area in 1936, the original levee breaks were repaired and water control structures were constructed. The purpose was to provide a waterfowl resting area protected from the river. The susceptibility of the area to flooding was recognized in the reconstruction efforts. Plans were made to build a setback levee in the southwest corner of the refuge in lieu of flood relief spillways which were required by the U. S. Corps of Engineers.

Before construction of the setback levee began, the private contractor for the job defaulted, claiming inability to perform. Faced with this, there was no alternative but to go ahead with the construction of the dikes on their original location, including the required spillways.



Dike construction and repair are the history of Lake Chautauqua

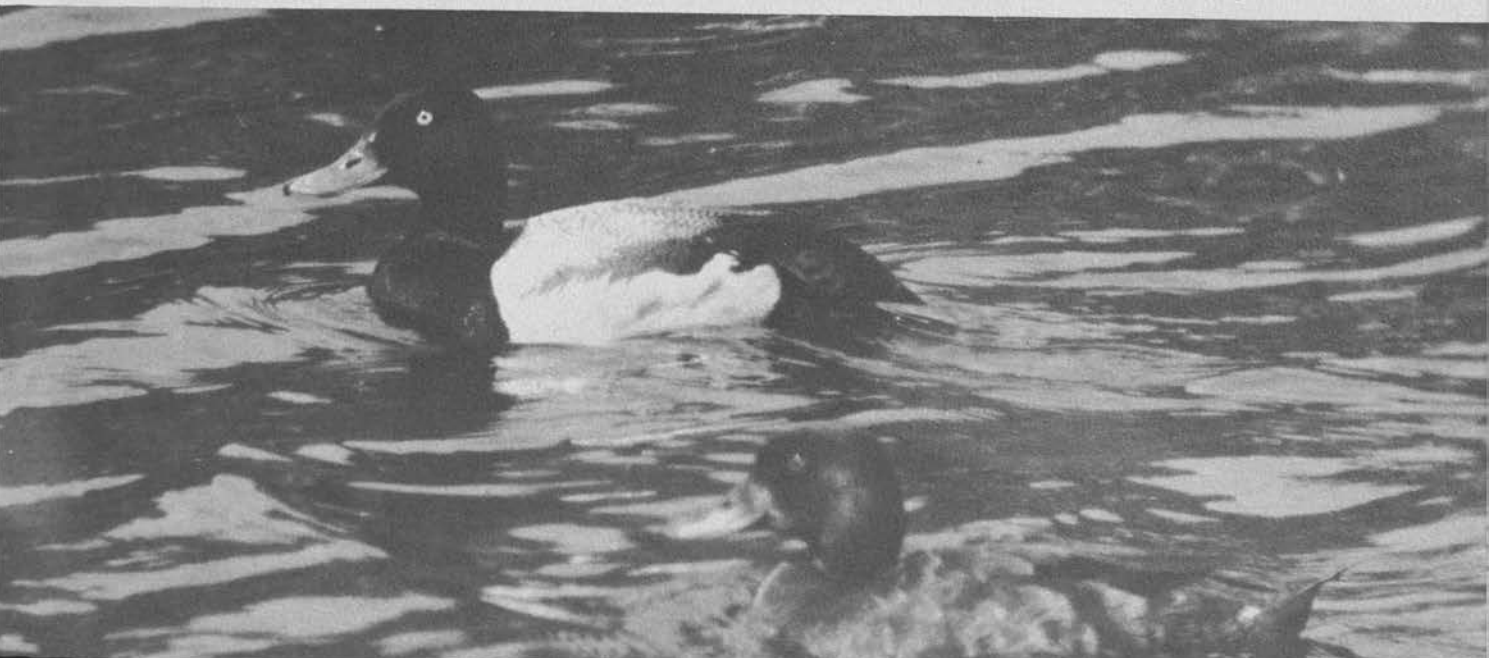


*Even the
slightest
rise of the
Illinois
River
tops the
refuge
spillways*

The spillways have never been satisfactory because the river has backed water over the spillways into the refuge more than 21 per cent of the time, preventing the management of stable water levels, the original management goal. Only in the early years of the refuge were duck foods really abundant.

In the early 1940's, record floods occurred producing a siltation condition which caused many of the aquatic and marsh plants to disappear. Since that time, these plants have continued to decline until today, only a few exist.

*Waterfowl now find the lake
much less attractive*



Since waterfowl food is recognized as an essential element of successful wildlife management at Chautauqua, attempts were made to initiate a management technique that is used successfully in the Illinois River Valley. Summer drawdowns of water levels were attempted to expose the lake bottoms for planting of millet or other moist-soil food plants. This attempt has not been too successful. The level of the Illinois River has often been too high for a gravity drainage drawdown or river levels have topped the spillways, flooding and destroying the crop.

In addition to the problems evident in low-water management, continuous actual physical damage to the dike from high water has recurred repeatedly. In the 30 years of government ownership, the spillway elevation has been exceeded in all but two years. The dikes have been damaged by overtopping, wave action and by erosion from barge bow waves. The dike system is currently in need of extensive and costly repairs.

High winds sweeping the lake can quickly eat out a dike





A narrow buffer separates private land from the lake

Land

The original management concepts of the refuge were based on the waterfowl sanctuary values of the lake itself. This, plus the purchase of the defunct drainage district, governed the original acquisition of upland to include only a small margin of the sand bluff along the southeast shore of the lake.

Much of this narrow upland strip contained lake front cabins, for at the time of the first acquisition, the lake was used as a water-related recreation site. The cabin sites were purchased by the government but many of the cabins are still occupied under life-tenancy provisions of government acquisition.

The bluff is heavily wooded with hardwoods which are valuable for wood duck nesting. The remaining small upland areas on the refuge are covered with brush or upland grasses. The ridge of land on the shore of the lake near the river is bottomland timber comprising mainly maple, cottonwood and pecan.

With the addition of wood duck boxes the bottomland timber is valuable duck nesting habitat





*Bird watching
is a popular
year-round
activity*

NATURE STUDY attracts 5,000 people to the refuge each year to watch birds, study plants and animals and photograph wildlife. The variety of wild lands makes it possible for visitors to see wildlife of the river, woods and field all in a period of a few hours. Waterfowl concentrations in the fall, bald eagles in the winter, warbler migrations in the spring and shorebird numbers in the summer are special attractions to bird watchers.

PICNICKING is one of the lesser public uses of the refuge for higher quality picnic areas are available elsewhere. Most picnicking is in conjunction with sport fishing trips to the refuge. The small refuge picnic area has fireplaces, a well and sanitary facilities.



*Organized groups
often use the
picnic area
during visits to
the refuge*

BASIC PROBLEMS

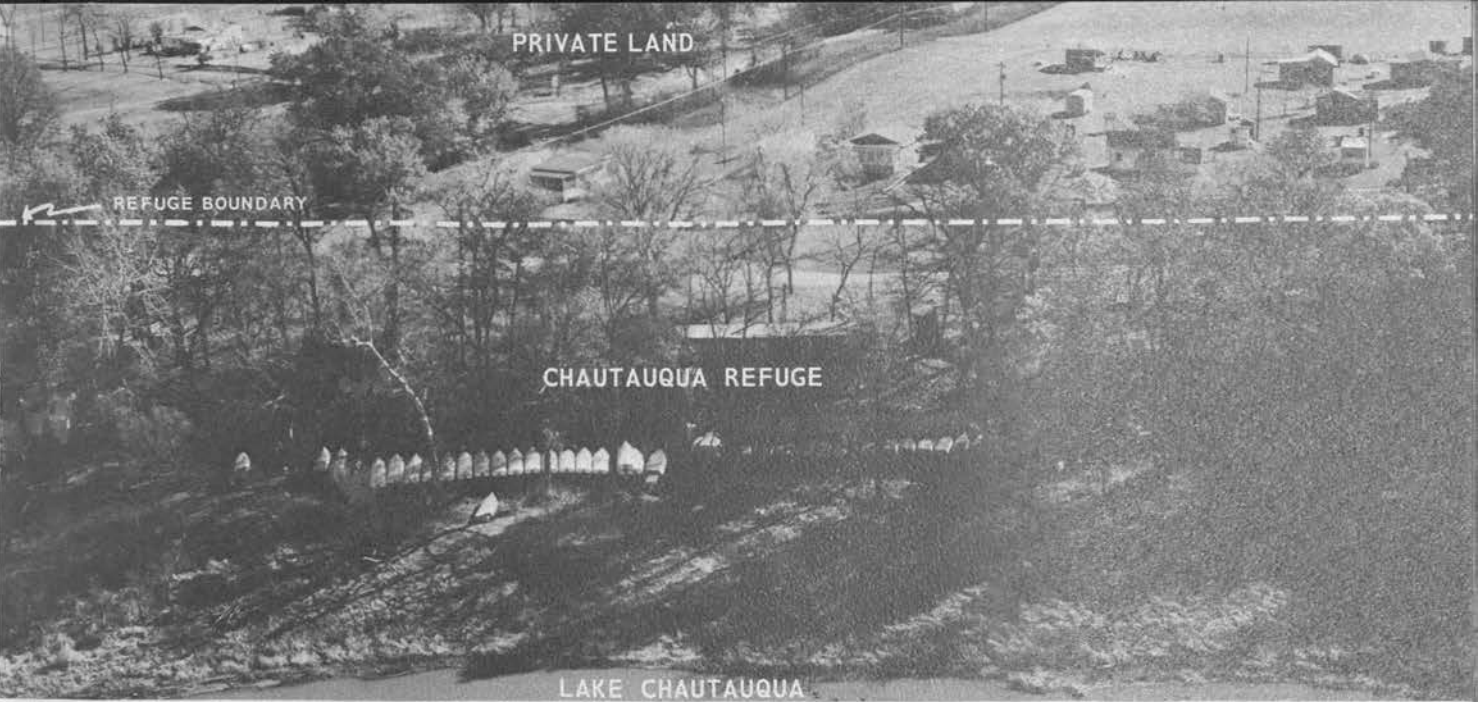
Many alternative development proposals were considered in the preparation of the Master Plan. These dealt with the potential development of the refuge and Lake Chautauqua proper. There are, however, a number of critical problems and conflicts which will influence the future use and development of Lake Chautauqua. Highlights of these problems are discussed in more detail below.

Land

The original management concept of the refuge was based solely on the sanctuary aspect of the lake itself. As the science of waterfowl management has broadened to meet the changing needs of waterfowl, the refuge management concepts have turned to providing all of the needs of waterfowl--food, water and rest. The refuge, however, has no agricultural land and has need of upland agricultural crops to supplement the aquatic foods for wildlife. Waterfowl foods such as corn and green browse can only be provided through upland farming.

*Refuge lands cannot furnish all waterfowl needs;
private lands must provide some waterfowl food.*





There is little expansion room for recreation

Additional land is also needed for recreational development. Chautauqua Refuge is one of the few areas in central Illinois which offers wildlife-oriented sightseeing and study activities. Based on information contained in the Illinois Comprehensive Plan for Outdoor Recreation, there will be a potential demand for 383,000 annual visits to this refuge by the year 1976. Visitors can be expected to spend at least a dollar per visit which could mean an additional \$383,000 return to the economy. Unfortunately, there are no sites on the existing refuge that are suitable for developments such as a camping area or visitor center to accommodate these visitors. The existing refuge can only handle 15 per cent of the demand.

In addition, existing real estate development adjacent to the refuge detracts from the desirable natural beauty. This crowding factor and the lack of a buffer zone between the lake and private developments are detrimental to the natural beauty of the area.

Lands adjacent to the southeast corner of the refuge were inspected and considered for acquisition. The decision was made against acquiring additional land, hence, all development outlined in this plan involves only lands and waters within the present boundaries of the refuge. Acquisition of recreational land and a buffer zone around the headquarters area should be reconsidered at a later date. Acquisition of upland agricultural lands for waterfowl feeding should be postponed indefinitely.

Flooding

Chautauqua Refuge is subject to frequent and severe floods. During the past 30 years of refuge operations, the cost of dike reconstruction and repair has been extremely high as a result of flood damage. This history of flood damage dictates the selection of substantial and adequately protected facilities. Furthermore, Presidential Executive Order No. 11296, dated August 10, 1966, directs federal agencies to construct facilities in such a manner they will not be subject to excessive flood damage. Therefore, all future construction on Chautauqua Refuge must follow this directive in development planning.

Sport Fishing vs Waterfowl Management

The most effective technique for managing a flood plain lake for the production of duck food is to lower levels sufficiently by July 1 to expose at least 30 per cent of the area in mud flats to allow moist-soil food plants to develop. The area is then reflooded in the fall months to make the plants available to waterfowl. This practice was initiated at Chautauqua in 1959 and since then has been the center of controversy.

Efforts to enhance sport fishing have been made by adjusting the water management program but these modifications have never really satisfied either sport fishing interests or the waterfowl management objectives.

Development and management of Lake Chautauqua for fishing and moist-soil food production on the same area at the same time is not possible since the desirable water depths for the two activities are directly opposite. Zoning the water area to accommodate both activities is an alternative.

Drawdowns, detrimental to fish life, are an effective method of producing duck foods



Siltation

In the spring and early summer of 1943 and 1944, near record floods occurred on the river. The flood water entering the refuge was heavily laden with silt and great deposits were made in the lake. Siltation that occurred during those flood periods produced drastic changes in the ecology of the lake. This light-weight silt deposited in the stilled waters of the lake has formed a loose, shifting blanket over the lake bed. Wind action and bottom-feeding fishes stir the material, creating a turbid condition which is detrimental to waterfowl and fish habitat. Prevention of siltation is possible only through isolating the lake from the river. Control of the turbid condition is possible through periodic drawdowns.

Pollution

One of the first major man-made changes in the Illinois River occurred in 1900 with the opening of the Sanitary and Ship Canal in Chicago, connecting the Illinois river with Lake Michigan. This diversion flushed untreated domestic sewage and industrial wastes down the canal and into the Illinois River. Since that time sewage treatment in the Chicago area has improved greatly but the rich effluent still affects the river downstream. Other cities along the river have grown and have added their wastes to the river.

This domestic pollution has improved and then worsened as new sewage treatment plants have been built, then became overloaded from the increase in human population. The result has been ever-diminishing wildlife habitat. There is little the refuge can do by itself to temper this decline; a combined effort of government, agriculture, industry and individuals is necessary to solve this problem.

A low oxygen supply as a result of pollution or low water is a killer of fish life



ANALYSIS OF DEVELOPMENT

Formulation of the Master Plan required numerous studies. These were not pointed merely toward rehabilitating existing facilities and conditions but were directed toward a logical and justifiable plan of development needed to accomplish refuge objectives.

Many development proposals were studied. Three principal factors were used in analyzing these. They were:

1. Effectiveness in meeting refuge needs.
2. Permanence of improvements to effectively minimize future flood damage.
3. Economic feasibility based on a favorable cost-benefit ratio.

Factor No. 1 received first consideration. The primary purpose of the total development planning process was to determine a course of action best suited to the refuge needs. Factor No. 2 was considered to be a mandatory requirement by presidential directive but even without such an order the Bureau of Sport Fisheries and Wildlife has an obligation to reduce the excessive maintenance burden. Factor No. 3 is, in essence, the final test of project worth. Although there are intangibles in an evaluation of refuge benefits, compelling reasons for overriding economic feasibility must be demonstrated.

Any refuge development must first meet the needs of waterfowl

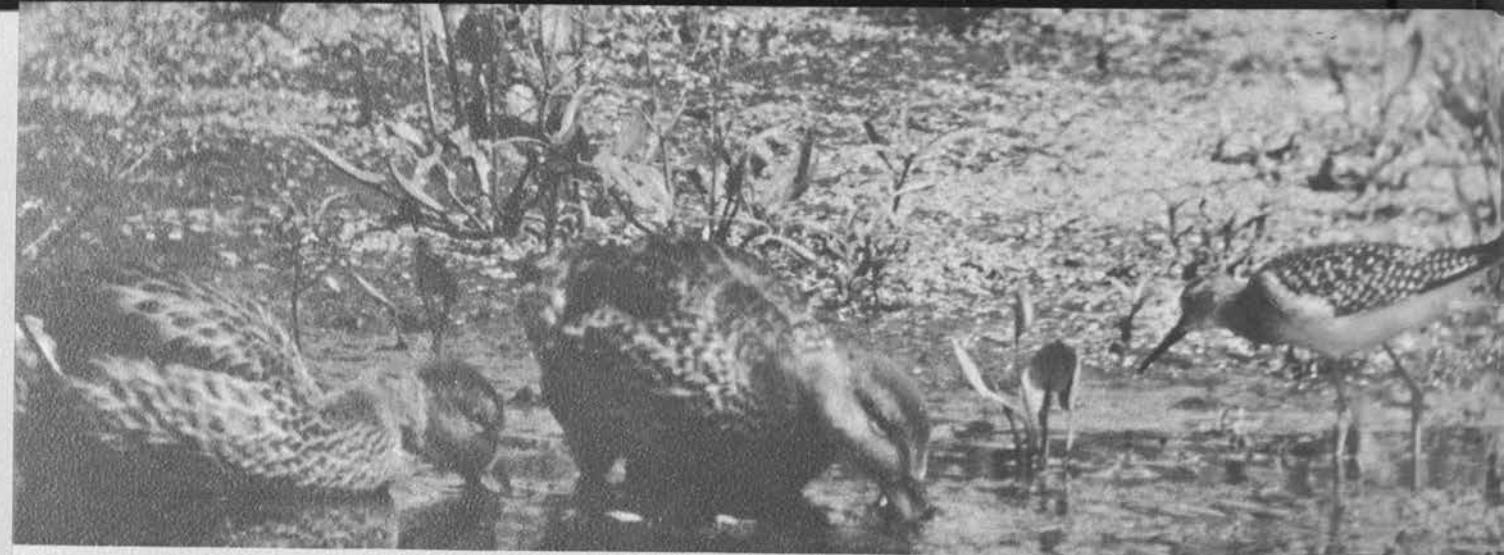




The occurrence of severe flood damage must be reduced

The development proposals ranged from rehabilitating the entire existing dike system with complete protective works to an abandonment of the entire dike system. Intermediate proposals included cross dikes, barrier dikes, high dikes and low dikes. Several proposals included provisions for reducing the present high maintenance costs and providing for a semi or fully controlled water area for fishing but did not permit improvement of waterfowl food development. Others provided for all three items but construction costs were exorbitant. None of the proposals fully met management objectives since land acquisition was considered prohibitive.

The proposal finally selected, and explained in this booklet met the waterfowl food producing requirement and reduced the amount of dike construction. The potential for flood damage was reduced and the cost is less than other proposals for equal wildlife benefits. The cost-benefit ratio also was favorable.



Aquatic food is vital to waterfowl survival

THE PLAN

Chautauqua National Wildlife Refuge, if developed, can fulfill its responsibility to the waterfowl resource and offer an opportunity for people to further their appreciation and understanding of wildlife.

Wildlife Development

The most important development feature for wildlife is the managed pool area in the northern end of Lake Chautauqua. This development will give the refuge a manageable moist-soil waterfowl food unit. A system of dikes and water control structures will allow water in the impoundment or pool to be managed to provide waterfowl food plants and to serve as a waterfowl resting area. The pool will be managed annually on a basis of complete drawdown in late June and early July, remaining nearly dry until early fall. This period will be sufficient for the maturing of moist-soil food plants popular with waterfowl. In the fall of the year, these plants will be gradually flooded to allow maximum use by ducks and geese.

These facilities will allow development and restoration of the lake as a feeding and resting area for fall populations of 200,000 ducks and 11,000 geese.

The portion of the lake not in the controlled pool will be managed as a waterfowl rest and brood area with sport fishing as a spring and summer use. The existing dikes will be left in their present condition and the area will be allowed to fluctuate with the river.

The major species of duck produced at Chautauqua Refuge is the wood duck. All of the timber on the refuge will be managed to produce wood duck nesting cavities and mast for wildlife food. In addition, nest boxes will be installed to supplement natural nesting cavities.

The grassland and brushland areas on the refuge will be allowed or encouraged to revert to natural vegetation. These areas will benefit a variety of birds and animals and provide visitors with an opportunity to study, observe and enjoy these inhabitants.

Several new buildings are needed in the headquarters area. Two residences will be built for use by permanent personnel. An equipment building and oil house will be built to store equipment and petroleum products.

A permanent staff of four people will be required for efficient refuge operations and to meet public needs for services.

*Wood duck production
is a high priority*





Auto tours to see wildlife will be encouraged

Recreation Development

Because Chautauqua Refuge has such a small acreage of upland, the recreational program must center around the lake itself. The main emphasis of the future recreational program will be on wildlife education and interpretation.

Public use and enjoyment of the area requires certain developments, the nucleus of which is the managed pool area. The pool will serve a dual purpose. It will attract numerous waterfowl and other water birds and the dikes which impound it will serve as a tour route for visitors.

The dike will be developed with turnouts and interpretive signs to allow for unhurried appreciation and understanding of wildlife and wildlife management. The route will be a self-guided auto tour that will provide access to a cross-section of attractions and highlights so the visitor may fully enjoy the story of waterfowl. Interpretive signs will be used to explain the natural characteristics of the refuge and to stimulate people to learn more about their natural resources.

*The refuge will be
an outdoor classroom*

An observation tower, an overlook, photography blinds, and nature trails will assist the visitor in enjoying representative sections of the river bottomlands and waterfowl habitat and in observing and studying plants and animals in their natural surroundings.

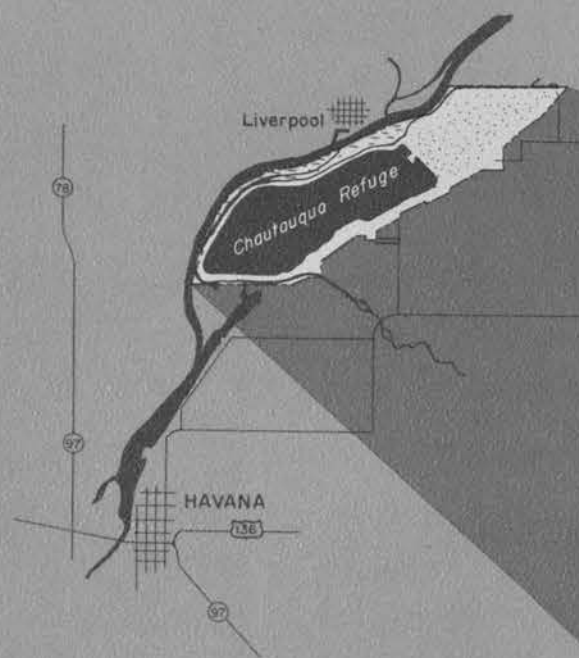
Chautauqua Refuge will provide a place to hunt waterfowl in an area where hunting places are in high demand. The extent to which refuge waterfowl hunting will be permitted will be measured by the response of the birds to the refuge management program.

The portion of the lake outside the controlled pool will be open to sport fishing during much of the year. Boat launching areas will be available on the lake and on Goofy Ridge Ditch. A concession building will be built at each launching site. These facilities will provide services to people who wish to rent boats, purchase bait, equipment and groceries. Public toilet facilities will be available in these buildings. In conjunction with the concession building, boat mooring facilities will be provided.

Picnicking on the refuge will be part of a day's visit. The existing picnic area will be enlarged to provide more tables and fireplaces.



*Sport
fishing
will
continue
as a
major
use*



Chautauqua National Wildlife Refuge

PROPOSED PLAN

- | | | | |
|-------|--------------|-------|-----------------------|
| ----- | NATURE TRAIL | ----- | BOAT LAUNCHING AREA |
| ▲ | OVERLOOK | □ | OBSERVATION PLATFORM |
| ⌵ | PICNIC AREA | ----- | SELF-GUIDED AUTO TOUR |



DEVELOPMENT COSTS

Water Facilities	\$1, 023, 300
Buildings	81, 200
Roads and Trails	57, 300
Structures and Utilities	18, 500
Fencing and Posting	9, 000
Recreation	49, 500
TOTAL	<u>\$1, 238, 800</u>

BENEFITS

Development and management of Chautauqua Refuge will contribute to the conservation of the national migratory bird resource and afford an opportunity for public enjoyment of waterfowl and other wildlife in its natural environment. Management of the refuge will provide both tangible and intangible benefits to the community, the state and the nation.

Tangible benefits are primarily those which contribute to the economy. A considerable part comes from expenditures by refuge visitors. It is estimated the general visitors will spend about \$60, 000 annually. Fishermen and hunters will spend another \$170, 000 and the direct return to the county from the Refuge Revenue Sharing Act is approximately \$1, 000, making a total annual return to the economy of \$231, 000.

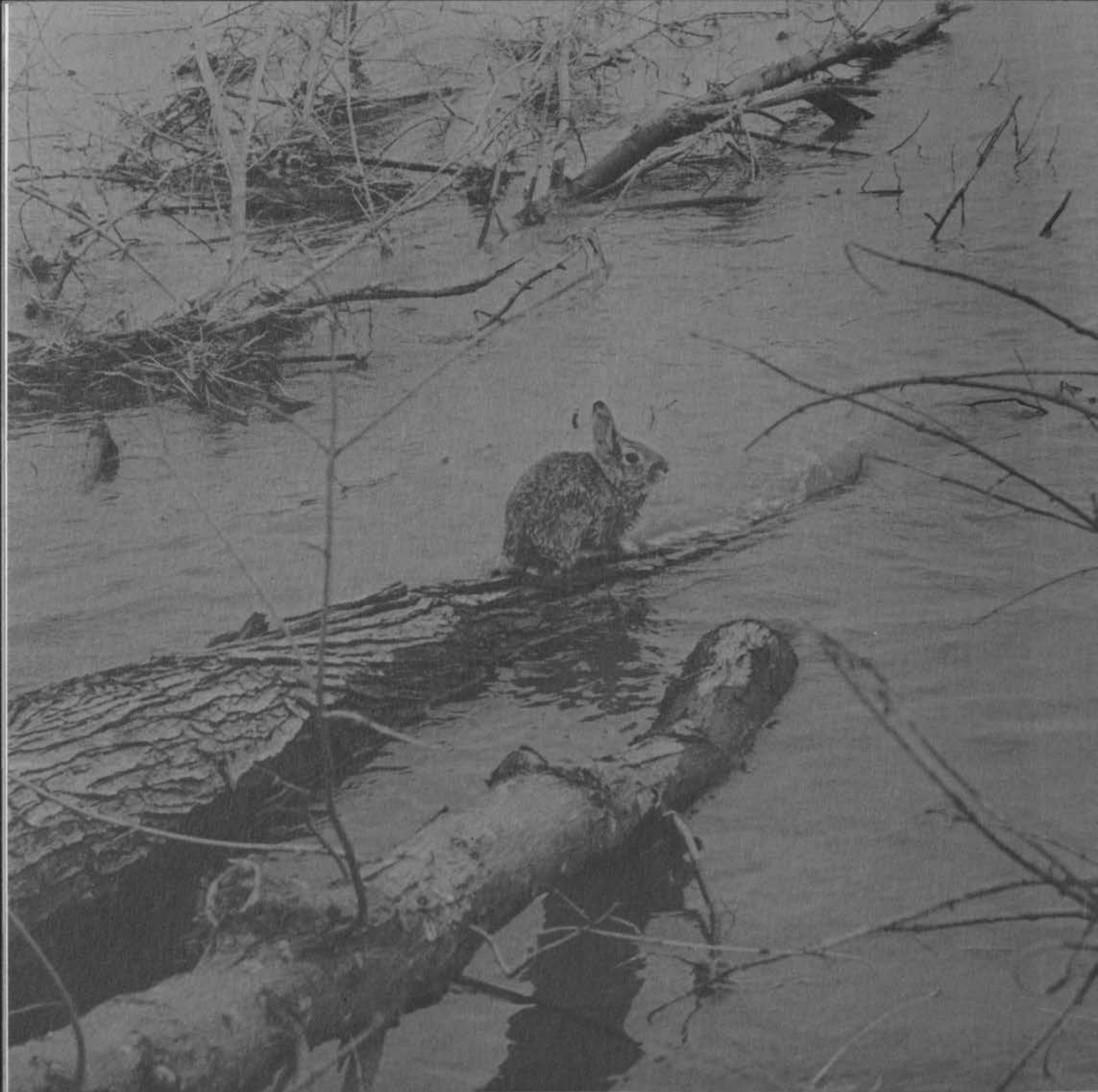
Not all of the benefits of the refuge can be measured in dollars. Its wildlife has values that are real but intangible, cherished primarily for esthetic reasons.



Created in 1849, the Department of the Interior -- America's Department of Natural Resources -- is concerned with the management, conservation, and development of the Nation's water, fish, wildlife, mineral, forest, and park and recreational resources. It also has major responsibilities for Indian and Territorial affairs.

As the Nation's principal conservation agency, the Department works to assure that nonrenewable resources are developed and used wisely, that park and recreational resources are conserved for the future, and that renewable resources make their full contribution to the progress, prosperity, and security of the United States -- now and in the future.





Nature will always extract some price for use of her flood plains.

Lyndon B. Johnson

*The President's Letter Transmitting
Report on Federal Flood Control
Policy August 10, 1966*

FORT NIobrARA

**NATIONAL
WILDLIFE
REFUGE**
NEBRASKA



A PLAN



UNITED STATES DEPARTMENT OF THE INTERIOR

FISH AND WILDLIFE SERVICE

BUREAU OF SPORT FISHERIES AND WILDLIFE

FORT NIOBRARA

NATIONAL WILDLIFE REFUGE

Lying at the north rim of Nebraska's sandhills, Fort Niobrara National Wildlife Refuge embraces the beauty and expanse of the grass-covered prairie and the wooded brakes of the winding Niobrara River. Within the refuge boundary exists a vestige of the once-vast North American grasslands, a place abundant with open space and sky.

Here nomadic Indians were first drawn by the teeming herds of plant-eaters that grazed this rich prairie -- the bison, the pronghorn, the elk and others. Here several Indian tribes lived on the abundance of these animals and plant life. After the bitter plains Indian War, the Fort Niobrara Military Reservation was established in 1879 to keep the Sioux on the reservations to the north and to keep peace on the frontier.

With the hostiles subdued, the presence of the fort and its "buffalo soldier" garrison attracted settlers to the sandhills. Longhorn cattle were "trailed" from Texas to the fort for rationing to the reservations and Texas drovers settled down to ranch or to bust sod with other new arrivals.

In 1906, the fort was abandoned as a military post but retained as a remount station by the Army until 1911. In that year, the fort then was transferred to the federal Bureau of Biological Survey by Executive Order. During the 1930's, additional lands were acquired within the exterior boundary.

Today, the 19,122 acre national wildlife refuge is administered by the Bureau of Sport Fisheries and Wildlife, Department of the Interior. Visitors here see a remnant of this once-endless virgin prairie that gave promise and hope to early Indian and white man alike.

"Her Calf" by
Frederic Remington



*A walk through
the woods is
a pleasant
diversion to
the prairie
dweller*



OUR PURPOSE

Goal of the national wildlife refuge system is to further a national program of fish and wildlife conservation by restoring, developing and managing the environment for these wild creatures. All of the natural resources of this refuge will be managed to accomplish this objective.

As part of this national effort, Fort Niobrara National Wildlife Refuge will support the following objectives:

Maintain representative herds of buffalo and elk in their natural environment for maximum public enjoyment. A herd of Texas longhorn cattle also will be preserved for this purpose.

Manage refuge lands, flora and fauna to provide an educational experience to visitors and an appreciation of prairie ecology. Preserving the natural beauty of this unique area is a primary consideration, as is preservation of existing historical features. These efforts will be compatible with preserving native prairie wildlife species.

OUR WILDLIFE LEGACY



Just a century ago most species of wildlife native to the prairies were found here. Bison of the Northern Herd followed the grass, pronghorn antelope also numbered in the millions and the plains were alive with animal movement. Wolves and coyotes followed the herds, the plains grizzly loafed unmolested and the elk, or wapiti, and bands of Audubon bighorn sheep browsed on the slopes of the river valleys.

White man's intrusion into the prairie brought sudden changes to the wildlife community. Prairie sod was broken, timber was cut, wild game was hunted relentlessly. The whole environment was altered and many species disappeared forever.

Every effort to restore the proper environment for many of these species is being made as part of the refuge management plan, both to protect these species from extinction and to help you enjoy this part of Americana.

Buffalo

We can only guess how many millions of bison, or American buffalo, once roamed the length and breadth of this continent -- early naturalists estimated 60 million or more. Ranging from Pennsylvania to northern Florida, from Mexico to the Northwest Territories, the bison were hunted to extinction east of the Mississippi River by 1860. By the 1890's, few were left in the West.

First reintroduced to Fort Niobrara Refuge were six animals donated by J. W. Gilbert, Friend, Nebraska, and two bulls from Yellowstone National Park. The original goal was to save this species from extinction. The goal now is to increase slightly the herd of 250 to occupy the available range and to allow the public to view the herd in its natural environment.

*A buffalo thundering
across the prairie
is a sight to behold*





*A majestic bull elk and his
harem are common sights*

Elk

Elk, living in the wooded river draws and ranging out onto the plains, were among the first large animals to be exterminated by the white man. Although once fairly common on the Nebraska prairies, the elk were particularly vulnerable to firearms and had largely disappeared from the state by 1880.

This majestic member of the deer family was re-introduced to Fort Niobrara along with bison in 1913. Elk management on the refuge is aimed at maintaining a herd of 50 to 75 elk in their native habitat where they can be seen by refuge visitors.

No new facilities are necessary to maintain this elk herd. Supplemental feeding is not necessary since the refuge pastures afford adequate year-around grazing.

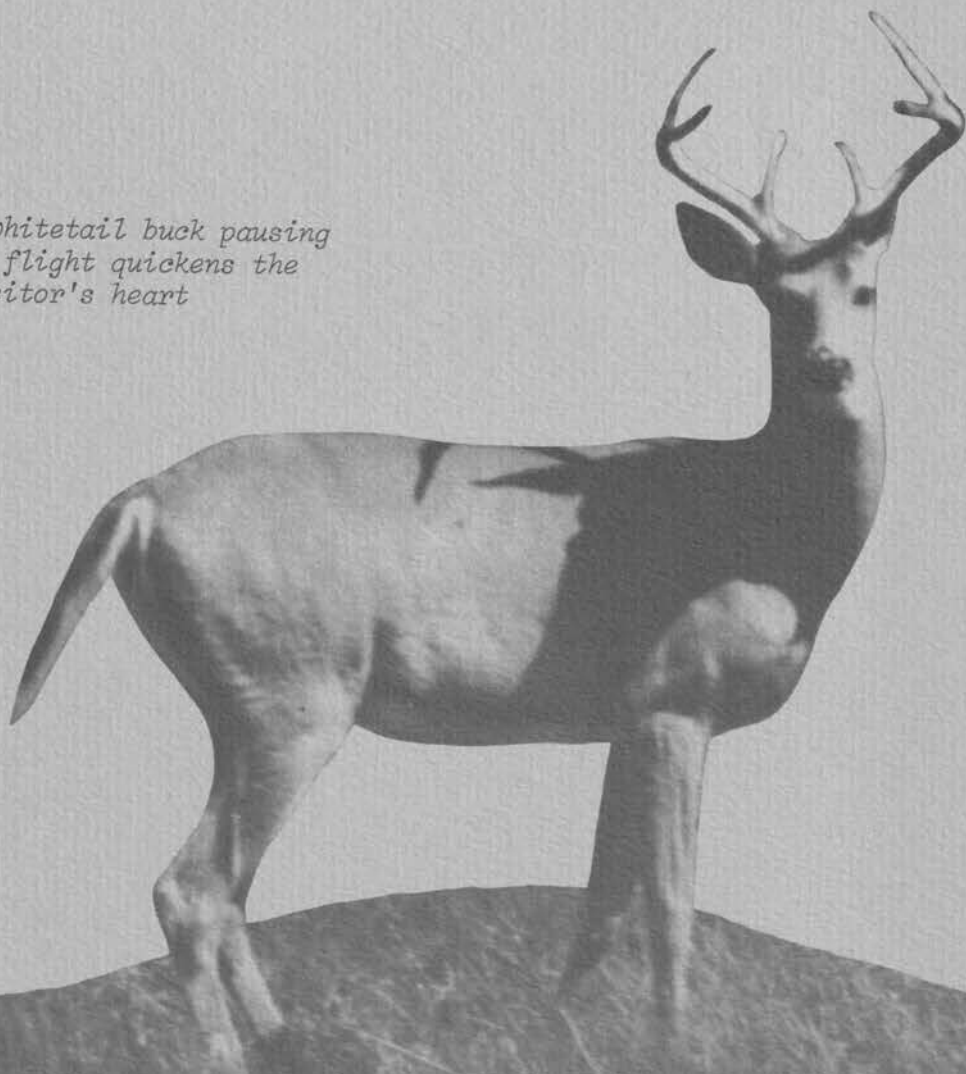
Other Wildlife

Both the white-tailed and mule deer browse and rest on the sandhills and the thickets and timber stands along the Niobrara River, both species being common to this part of the United States.

No specific management is necessary for deer as they benefit from management programs for other wildlife species and travel to and from the refuge and adjacent lands. Refuge habitat conditions are such that visitors will continue to observe these wild deer on the refuge lands.

In sharp contrast to the nomadic habits of the bison is the community life of the noisy, sociable prairie dog. Their "towns" are characterized by mounds of dirt around each burrow entrance and the grass nibbled short between the mounds. In the typical "dog town" found on the refuge, the surface entrances connect miles of underground passages. Visitors with binoculars and cameras spend many hours watching these busy rodents.

*A whitetail buck pausing
in flight quickens the
visitor's heart*



*Blacktail prairie dogs,
a rare species, are
assured protection*



Depending on the time of your visit and the sharpness of your eye, you may see other small prairie mammals on the refuge. These include beaver, bobcat, raccoon, mink, muskrat and coyote. All are native and have a part in the refuge's wildlife community. Only when excessive numbers occur are these species controlled, and then in accordance with state laws.

One sound which greeted Indians and pioneers alike still cuts the morning stillness of a spring day. That is the booming sound of the prairie chicken on its courtship grounds. To court the female, the males congregate on "booming grounds" where they strut, inflate colored air sacs in their necks, raise their feathers, then expel air from the sacs to create the peculiar booming sounds.

Though infrequently observed, prairie chickens are a bonus to the visitor interested in seeing refuge wildlife for these birds are considered a rare species. The sharp-tailed grouse, another hen-like bird of the prairies, is more abundant. The grasslands of the refuge are being managed for both species.



Other game bird species seen in limited numbers on the refuge are the ringnecked pheasant, bobwhite quail and wild turkeys. No especial management programs are carried out on the refuge for these species.

*An upland plover, symbol of
many interesting prairie birds*

PUBLIC RECREATION

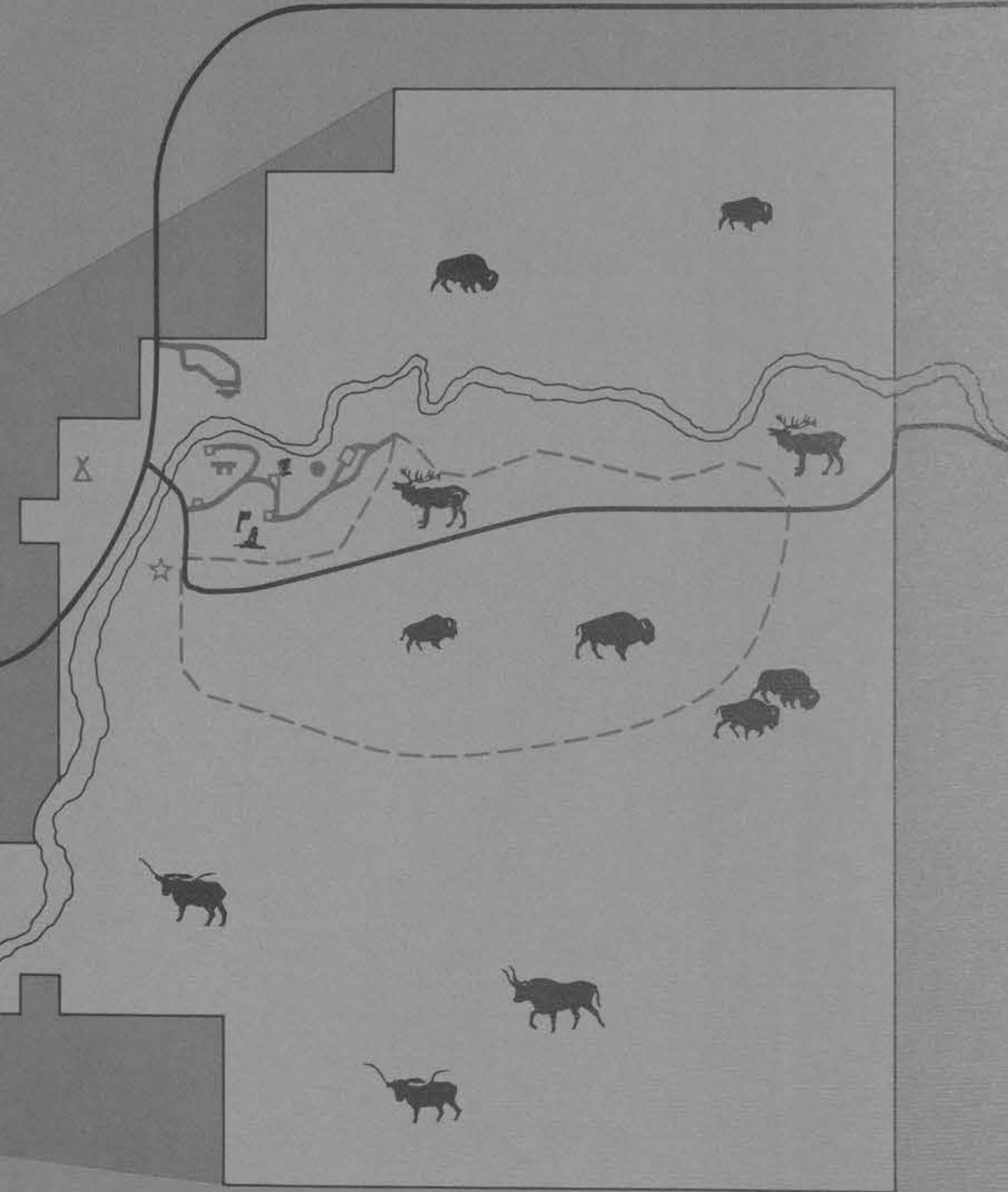
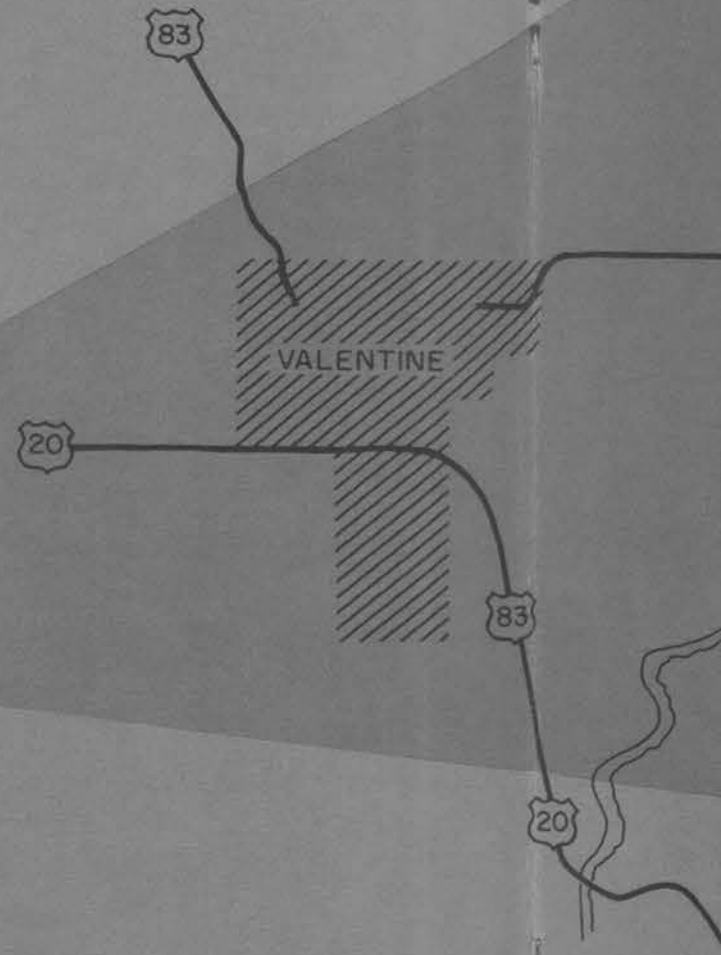
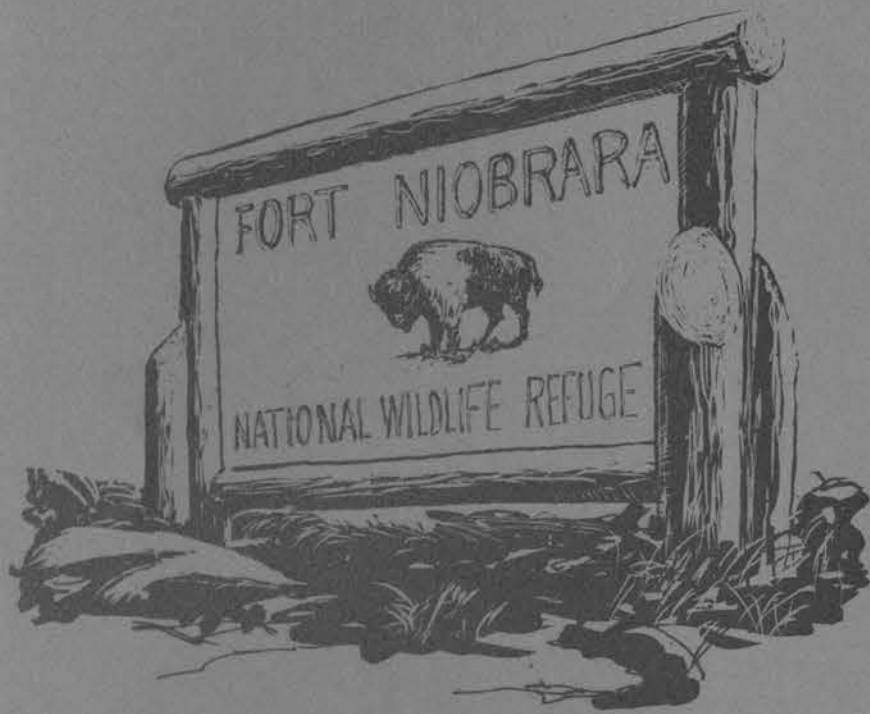


Originally, the primary purpose of the refuge was to preserve and protect the bison, elk and related prairie species in this high-plains environment. Today, this threat of extinction has lessened considerably.

Emphasis now is being given to managing the refuge's animal and land resources to provide for maximum public enjoyment of these resources and to assist the public in enjoying these features.

*Tumbling Fort Falls
highlight a refuge visit*





PROPOSED PLAN

- | | | | |
|--|-----------------------------------|--|---------------------|
| | OVERLOOK | | HEADQUARTERS |
| | PICNIC AREA | | INTERPRETIVE CENTER |
| | SELF-GUIDED AUTO TOUR | | |
| | PICNIC AND CAMPING EXPANSION AREA | | |
| | OLD FORT NIOBRARA | | FORT FALLS |
| | PRAIRIE DOG TOWN | | |

*Man, his
sons and
wildlife*



Sightseeing and Photography

If you want to see such majestic animals as the bison, elk or longhorn cattle in their natural environment, you will have some memorable moments at Fort Niobrara National Wildlife Refuge. Most of the 90, 000 persons who will visit the refuge each year will go there to see the wildlife. Many of these visitors will be local Nebraskans out for a day's drive but at least 35 per cent will be visitors from outside Nebraska.

To help visitors see wildlife during their visit, tour routes through the refuge will be paved and observation points installed. Signs will guide the visitor to scenic and historic points.

Photographers will have excellent opportunities to photograph herds of bison, elk and longhorns at close range. The scenic beauty of the rolling grasslands, the wildlife, the Niobrara River, the prairie flowers and the seasonal changes in the scenery make the refuge a year-around challenge to amateur and professional cameramen alike. Sightseeing and photography opportunities will be encouraged and assisted by the refuge staff to the fullest extent.



*The winter beauty
along the
Niobrara River is
unsurpassed*

Understanding the Past and Present

Fort Niobrara National Wildlife Refuge affords a unique opportunity to help Americans understand and appreciate a natural setting and its contributions to wildlife and man, past and present.

On the spot where you stand, prehistoric creatures once lived and died, wandering Indians once killed bison with club and spear, and troops once drilled.

To tell this story and its relation to wildlife, a variety of interpretive programs will be carried out on the refuge. An interpretive center, trails, and other interpretive devices will supplement the regular refuge programs so that visitors may understand the role of the refuge in preserving the natural resources of the area.

The interpretive program will focus on wildlife and three other aspects -- nature, history and geology.

Key facility will be the interpretive center. It will be a two-story building with exhibits, an auditorium, restrooms, information area, and observation decks. The center will provide an organized information and education program, distribute information about the refuge and act as a starting point for a nature trail, a trail to nearby fossil beds, a scenic trail to a vista overlooking Fort Falls and the river valley, and a self-guided automobile tour.

Only a few building sites remain of original Fort Niobrara



*Prairie
vegetation
fascinates
the visitor*



*Picnicking
on the
refuge is
part of a
day's visit*



Picnicking

Families and organized groups visiting the refuge will find picnic facilities for their convenience. A picnic site will be developed in scenic surroundings near the Niobrara River.

Float Trips

A float trip down the rippling waters of the Niobrara River coursing between the pine-covered bluffs is an opportunity infrequently found on the Great Plains. Float trips through the refuge by canoe will be encouraged. A launching ramp and parking area are planned where the refuge entrance road crosses the river. Embarking from this point, canoeists can travel downriver with ease to a terminus point a few miles east of the refuge.

*Canoeing on
the Niobrara
River is an
exceptional
way to see
the refuge*



OTHER FEATURES OF INTEREST

Texas Longhorns

One of the more important animals in the history of the cattle states of the prairies is the Texas longhorn. Although a domestic rather than a wild animal, the longhorn played an important role in the history of the refuge, the surrounding area and the cattle industry.

Originally, Texas longhorns made up the bulk of the "critters" on the trail drives north out of Texas to the northern plains states where they became both the foundation herds of many cattle empires and the periodic government meat ration to the Sioux, Cheyenne and other Indian tribes quarantined on reservations following the Indian Wars.

Had the federal government not sought out the few typical Texas longhorns still alive in 1926 in an effort to preserve this type, the longhorn may well have passed out of existence. The Fort's herd started from six longhorns brought here in 1936 from the Wichita Mountains National Wildlife Refuge in Oklahoma.

The present herd of 225 longhorns will be increased to 300 animals. The longhorns do not compete with the bison, each herd using separate pastures. Proper pasture management and range grazing programs will provide adequate forage in a natural range setting.

Visitors will enjoy seeing this herd which includes all colors and age groups with the full range of horn development.



*Longhorn
steers add
to the variety of
the refuge*



*Sandreed
grasses
appeal to
students
of the
prairie*

Land

To a person accustomed to the city, the forests or the rolling farmlands of other regions, the dry, treeless plains seem to be a forbidding wasteland. Early settlers likened the prairies to the oceans, with the rippling sea of grass covering the gentle swells and dips of the land.

The upper plains are among the great grassland areas of the world. Each supports its own different communities of wild creatures and each has its seasons of bloom and blight. In the wet season, the prairies are a vast, soft carpet of gray-green plant life but in times of drouth, the withered grass lies in brittle curls close to the earth.

More than 14,000 acres of the refuge will be kept in native grass cover. Grazing will be rotated to maintain a strong, healthy vegetative cover on this land.

Water

To many visitors, the green valley of the Niobrara will be an oasis after crossing miles of windswept, treeless plains. To the bison and other plains wildlife, the Niobrara River was one of the few dependable sources of water after the summer winds had burned the moisture from the prairie sod and baked the bottoms of creeks and ponds.

Today, fences prevent the bison and elk from drifting into the river. Wells on the refuge furnish needed water to wildlife as well as to help in distributing grazing.

A portion of the Niobrara River is being considered for classification as a wild river. That portion flowing through the refuge will be maintained in its present wild state in accordance with wild river standards.



*Fence maintenance
is a routine chore*

OPERATION

Many of the present refuge facilities are inadequate or need major rehabilitation. The entire road and trail system and all service buildings must be replaced or extensively improved. Buildings used for staff housing are inadequate and need replacement. Condition of present big game fences is poor and should be replaced. These improvements, plus a permanent staff of eight, are necessary for efficient refuge operations and to meeting public needs for services.

BENEFITS

Benefits of Fort Niobrara National Wildlife Refuge cannot be measured in dollars. Its natural beauty and wildlife have values that are real but intangible, cherished primarily for esthetic reasons. Wildlife such as the bison is valued in particular because of the part it played in our history.

Measured benefits are primarily those which contribute to the local economy. A considerable part comes from expenditures by refuge visitors. It is estimated that these visitors will spend about \$90,000 annually in this locality. In addition, the direct return to the county from the refuge revenue sharing act will be approximately \$10,000 making a total annual return to the local economy of \$100,000.

COSTS OF DEVELOPMENT

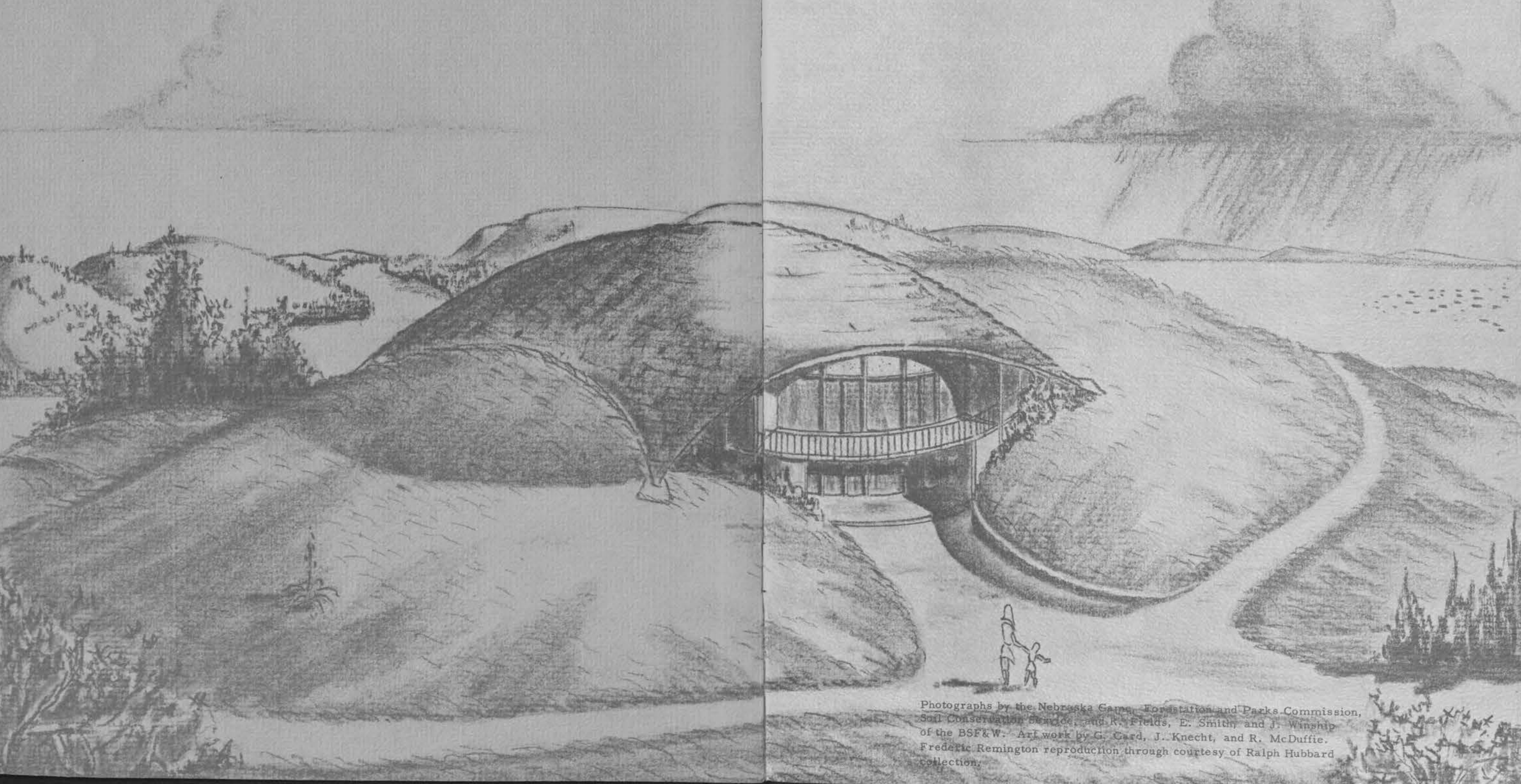
Buildings	349,000
Fencing and posting	212,700
Roads	35,000
Structures and utilities	187,000
Recreational development	626,300
Total	1,410,000

*The view from the north
overlook is unparalleled
on the prairies*

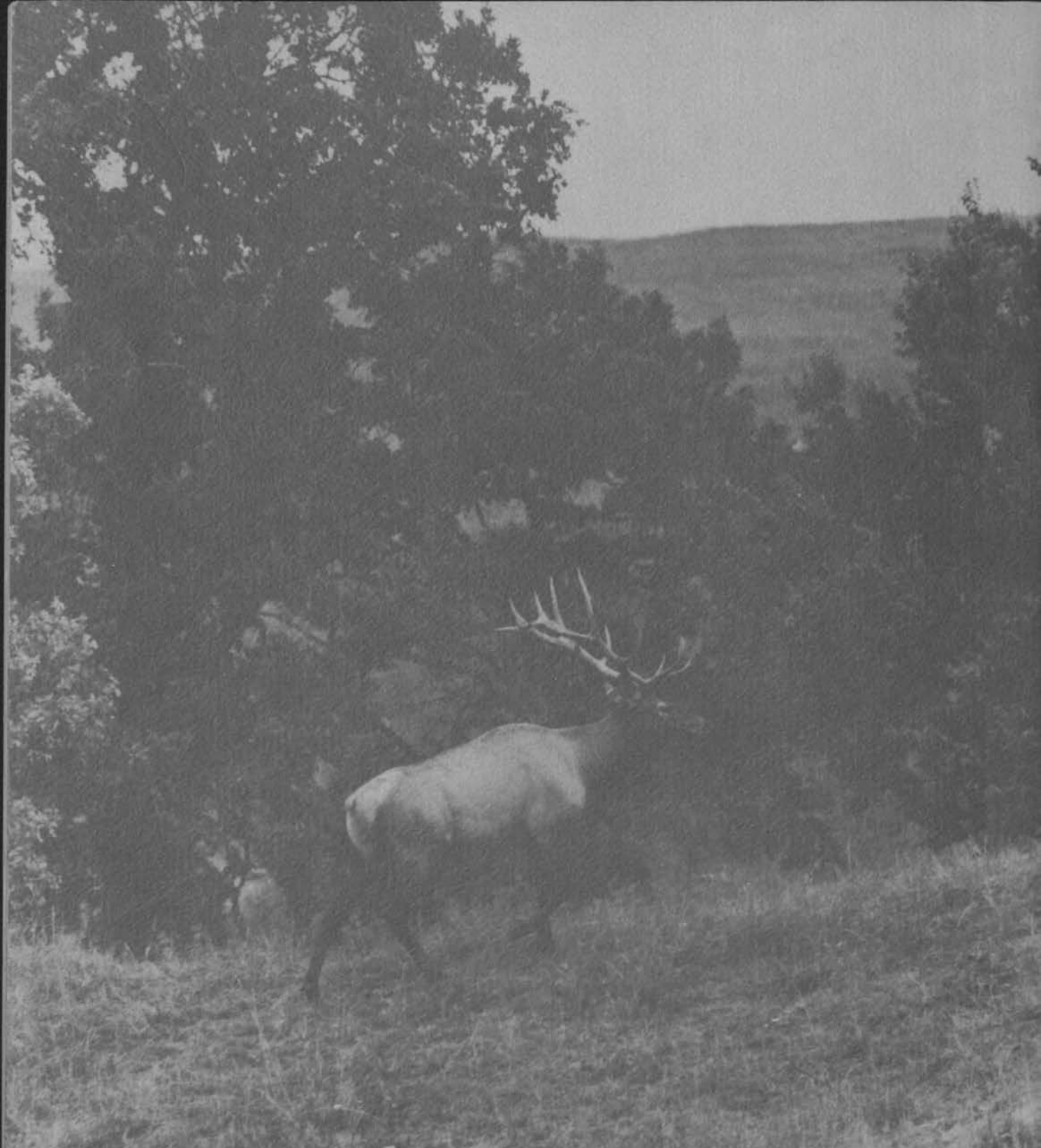


INTERPRETIVE CENTER

The site selected for the center has a commanding view of the Niobrara River Valley to the north with its steep coulees and river banks sprinkled with ponderosa pine. The view to the south encompasses the undulating sandhill prairies covered by a sea of grass and grazing buffalo. The center's domed roof configuration and covering will blend with the natural surroundings of hills and prairie grasses.



Photographs by the Nebraska Game, Forestation and Parks Commission, Soil Conservation Service, and R. Fields, E. Smith, and J. Winship of the BSF&W. Art work by G. Card, J. Knecht, and R. McDuffie. Frederic Remington reproduction through courtesy of Ralph Hubbard collection.



Created in 1949, the Department of the Interior—America's Department of Natural Resources—is concerned with the management, conservation, and development of the Nation's water, fish, wildlife, mineral, forest, and park and recreational resources. It also has major responsibilities for Indian and Tribal affairs.

As the Nation's principal natural agency, the Department works to assure that nonrenewable resources are developed and used wisely; that park and recreational resources are conserved for the future; and that renewable resources make their full contribution to the progress, prosperity, and security of the United States—now and in the future.

Waterfowl

Production Areas

South Dakota



WETLANDS FOR

... WATERFOWL



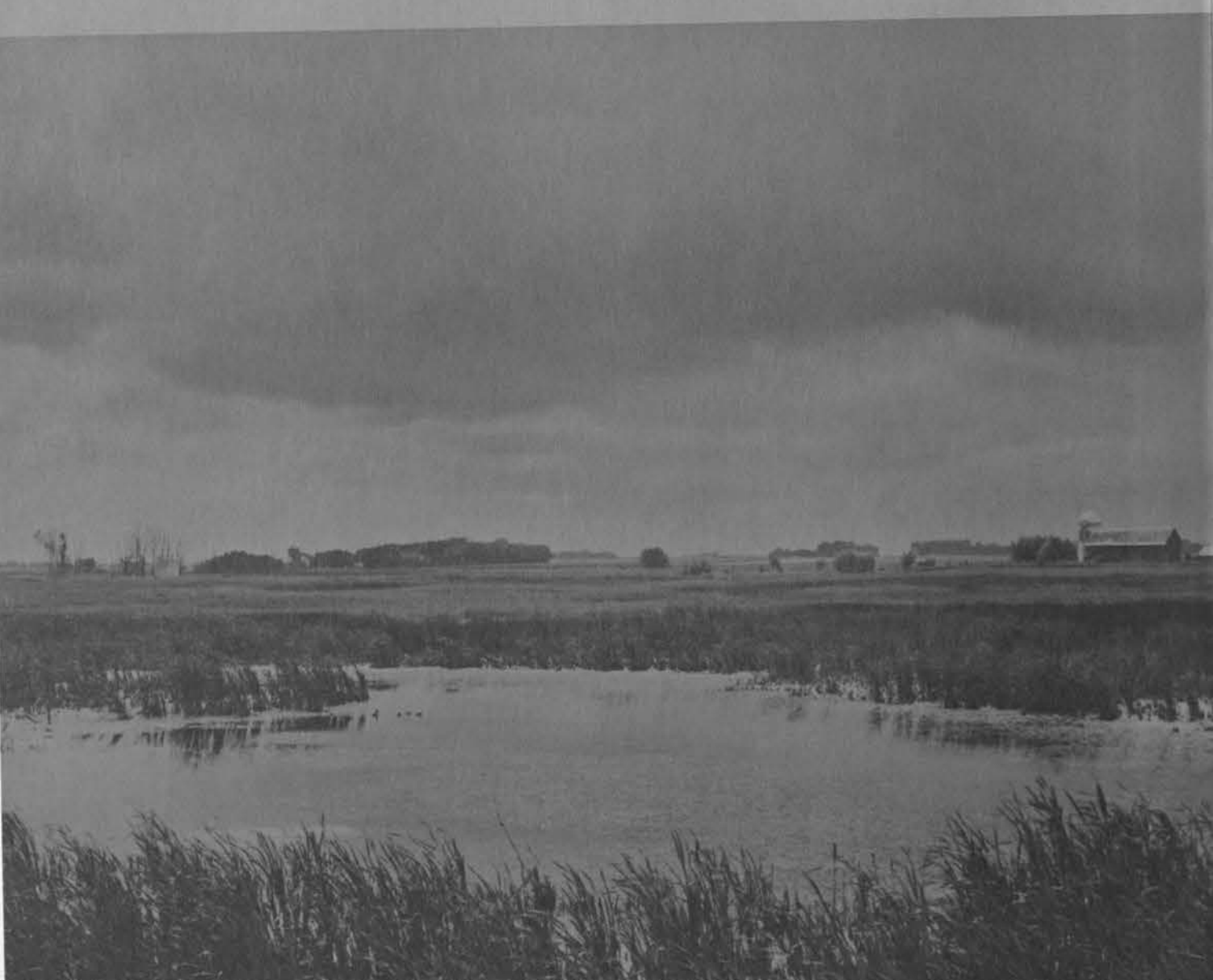
... OTHER WILDLIFE



... AND PEOPLE

*"First, all America has a stake in our migratory birds--
we must establish while we can, islands of natural
habitat and havens where our wildlife can rest and
reproduce."*

Stewart L. Udall
SECRETARY OF THE INTERIOR



UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE

The prairies of eastern South Dakota are dotted with lakes, marshes and potholes. These numerous and varied wetlands support rich plant and animal life.

South Dakota's Wetlands

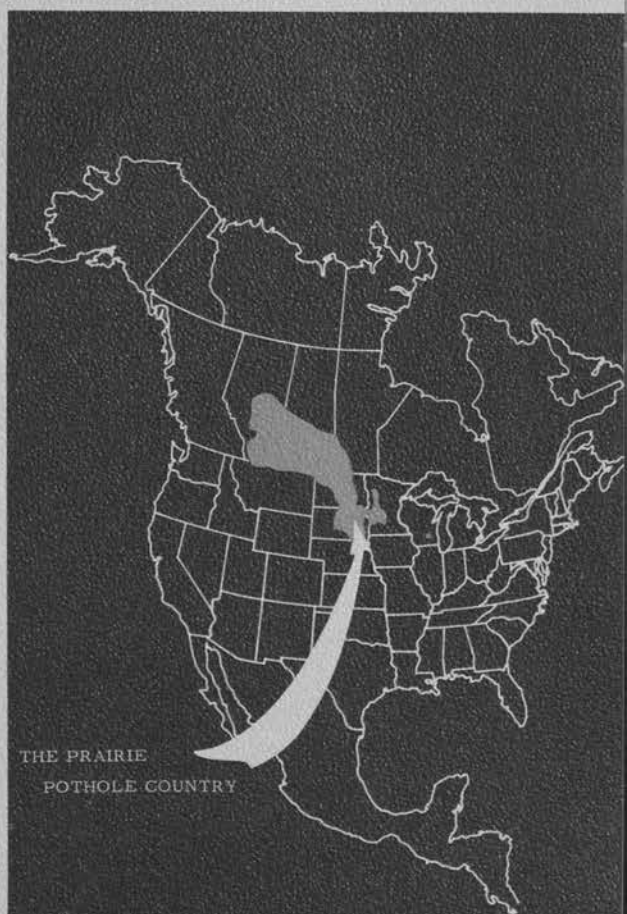
Without such wetlands, there can be no wild waterfowl. Wetlands produce ducks in abundance but also provide food, water and cover for other forms of wildlife. Man enjoys wetlands for the recreational opportunities they afford and should value them as water retention basins in the semi-arid high plains.

Since these wetlands are vital to man and his way of life, there is a public responsibility to see that they are preserved. The Bureau of Sport Fisheries and Wildlife is the federal agency charged with this responsibility.

Many of the more permanent wetlands will be preserved by public ownership. These lands will be actively managed and, in South Dakota, will eventually total about 1,000 areas averaging 100 to 140 acres each. Around these permanent wetlands, the small temporary wetlands will be protected from destruction through a payment to private landowners for their agreement not to drain, burn, fill or level these wetlands.

Development of purchased areas will include establishing waterfowl and upland game nesting cover, fencing and posting the areas for protection, and developing wildlife demonstration areas.

The estimated total development cost of the purchased areas in South Dakota will be \$2,600,000.





THE WETLANDS

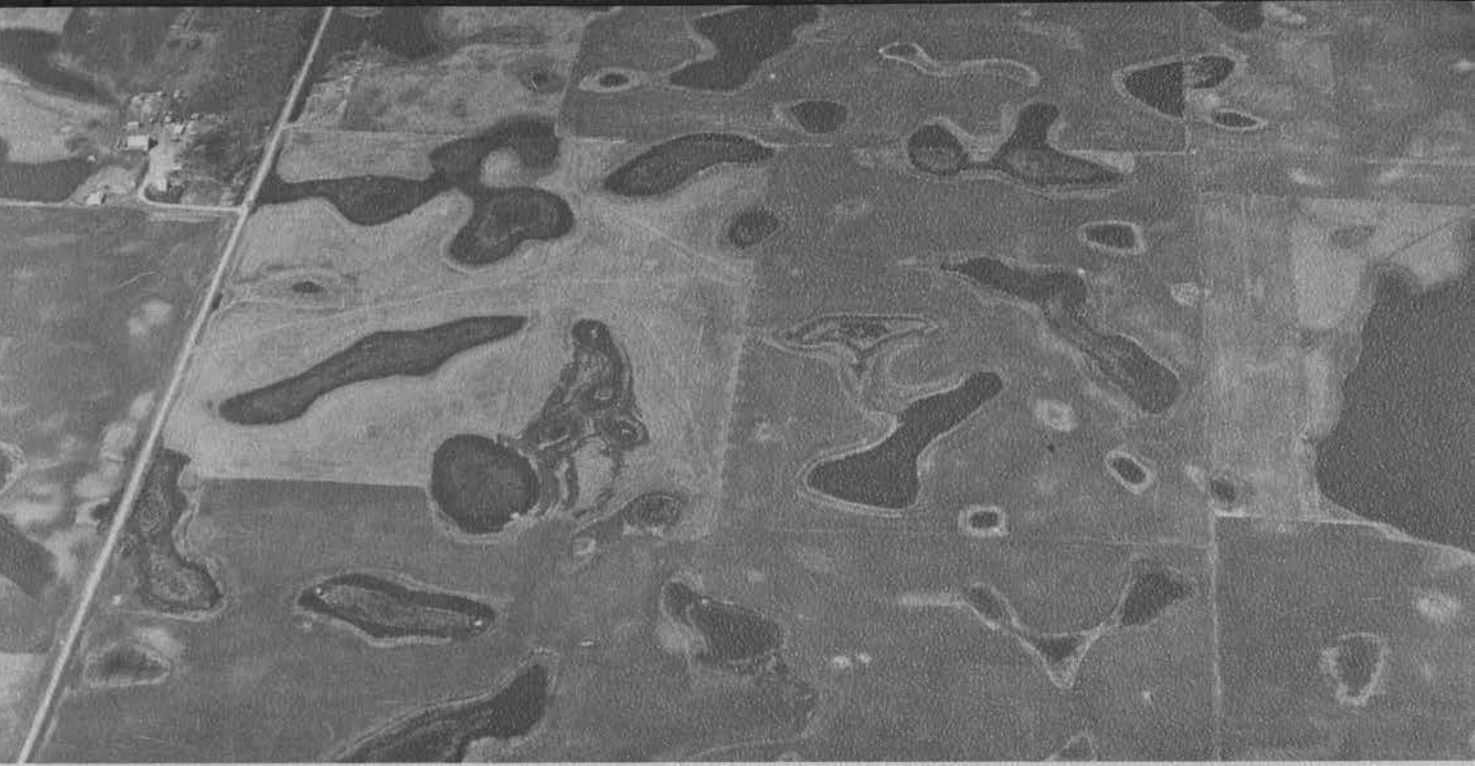
When the mammoth glaciers of the Ice Age retreated across the Northern Great Plains, millions of depressions were left on the landscape. Today, these depressions are lakes, marshes and potholes.

Commonly known as the "prairie pothole country", this water-speckled land is the backbone of duck production in North America. These wetlands are among the best duck-producing areas in the world.

While South Dakota wetlands form but a portion of the total "pothole country", they are significant to wildlife and people of the state and nation.

*Wildlife and wetlands are
synonymous on the prairie*





*Wetland numbers and variety
characterize the "pothole country"*

The very distribution and variety of eastern South Dakota's wetlands make them attractive to waterfowl. Ranging from temporary sheet water which lasts only a few days in early spring to permanent lakes, marshes and potholes, they meet the varying breeding, nesting and migration needs of many waterfowl species.

Because they are numerous, densely distributed yet separate, varied in size and containing many types of vegetation, they have been able to meet the changing needs of waterfowl during their different stages of life. South Dakota wetlands usually are high in fertility and support many forms of plant and animal life.

These are the characteristics of the prairie wetlands which have made them the focal point in the continent's waterfowl production for untold centuries. Without these wetlands, North America's waterfowl would decline rapidly. With wetlands gone, the high plains would become a flat, featureless expanse of grass and grain.



THE VALUES

The history, tradition, culture and character of America has always included wildlife. Wildlife is a part of America's cultural past and present; its history when wildlife sustained the pioneers as food and fibre; its industry of years gone by; its health-giving outdoor recreation to active men and women; its grace and form in our natural landscape; its mystery to the curious; its lessons in family duty and affection between mother and young.

The wetlands community of wild flowers, grasses, birds and other wildlife gives us the sound, the color, the movement, the very pulse of the prairie. Man, in his awareness of this living wetlands community, renews his ties with nature.

*Wetlands provide needed
winter cover to pheasants*



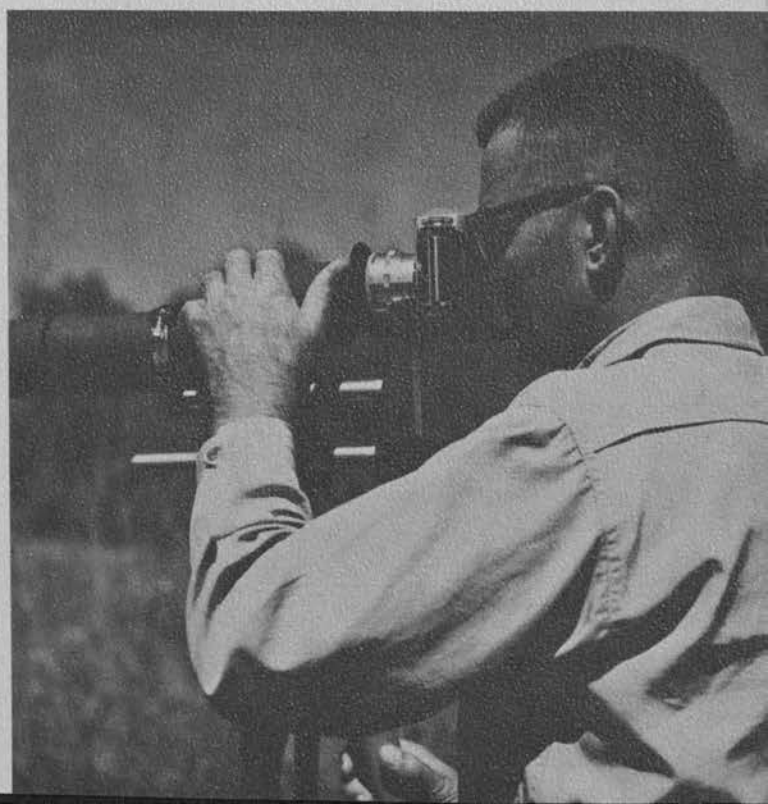
*Wetlands are vital
to duck production*

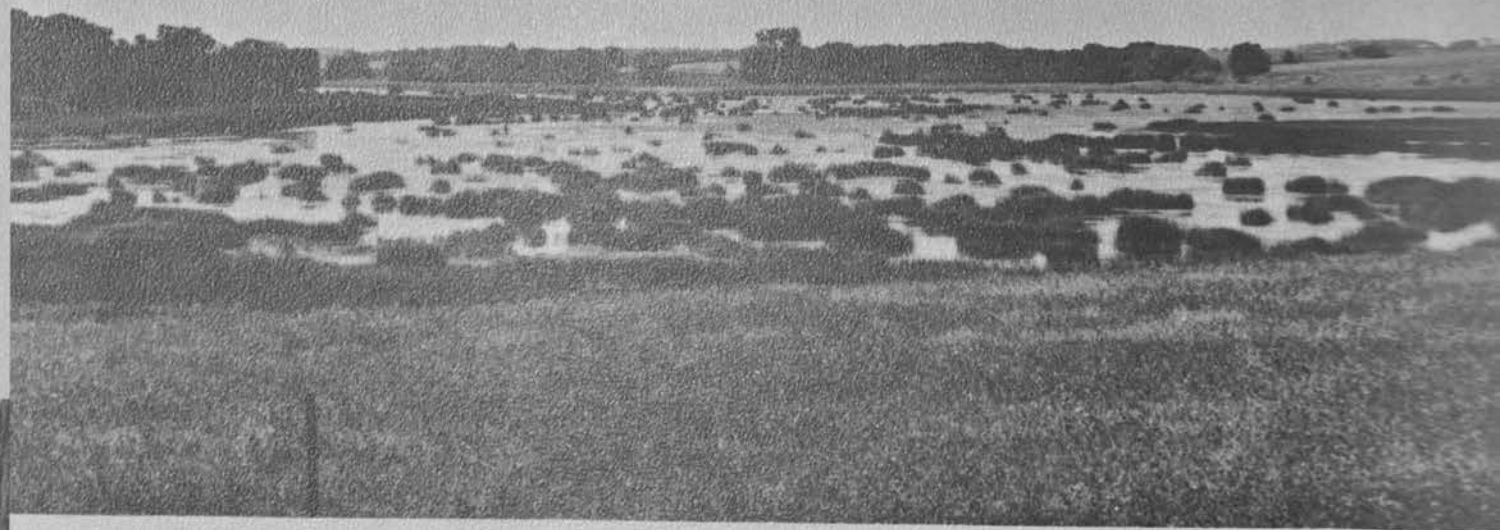


If man is to continue to enjoy waterfowl for all their values, he must preserve wetlands. Without wetlands, waterfowl and the myriad other forms of life in the wetlands community, cannot survive. The equation is that simple.

*Wetlands offer a variety
of recreational opportunity*

Today, the sportsman is only one of many Americans enjoying our wetlands.....the photographer, the botanist, the bird-watcher, the youngster with curiosity about his or her world, or those who find solace or inspiration in meditating on the mysteries of nature. What diminishes our wetlands resource diminishes all of us.





Wetlands are valuable natural reservoirs

Wetlands have values beyond those of recreation and esthetics. They help maintain ground water levels in the high plains where soil moisture often spells the difference between abundance and crop failure. As water retention basins, wetlands are valuable in preventing more extensive damages in years of heavy runoff and flooding.

What is wildlife worth?

Certainly the values are real but, in the main, are intangible. Wildlife is valued primarily for esthetic reasons today and for the part it played in our earlier history.

But wildlife also has great economic value and wetlands, in their supporting role, are an important part of these values. Duck hunters in the United States spend \$87 million a year for such items as food, lodging, travel and equipment. In South Dakota small game hunters can be expected to spend between \$10 and \$15 million a year. Hunting is seen as a sport and as a source of profit. Wetlands, private or publicly-owned, contribute to this sporting industry by providing game habitat.

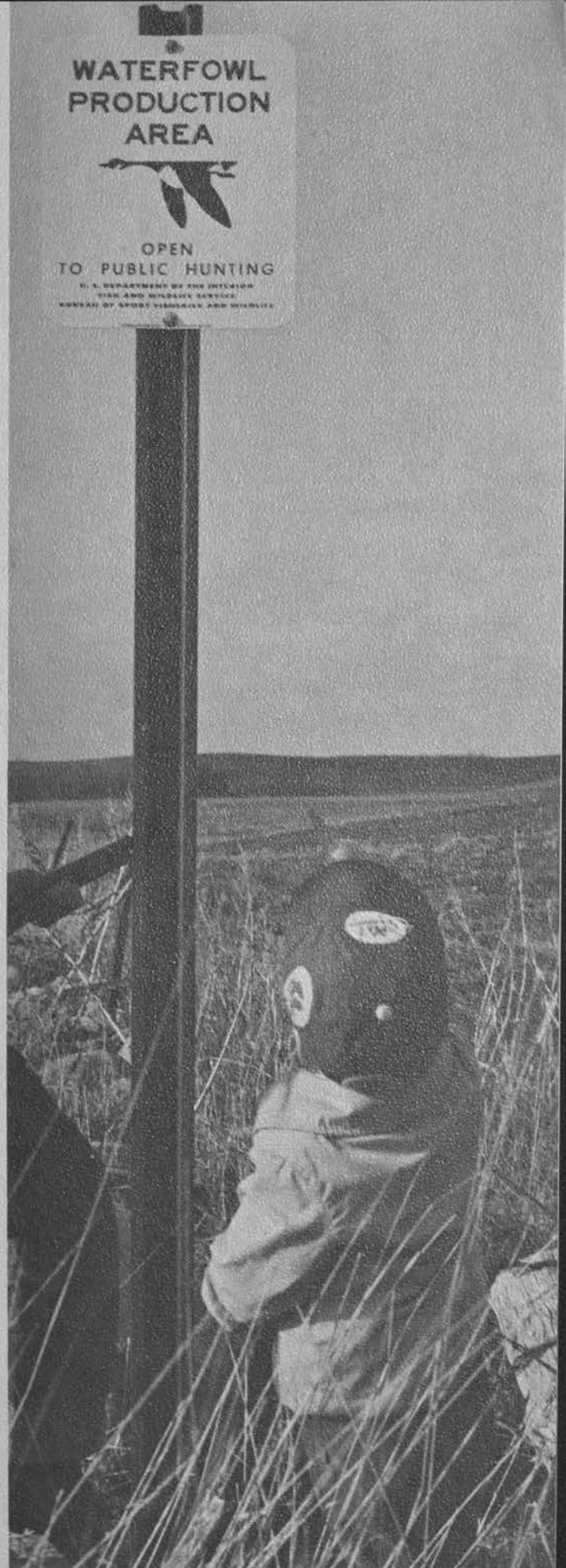
*Wetlands preserved now are
an investment for the future*

WATERFOWL
PRODUCTION
AREA



OPEN
TO PUBLIC HUNTING

U. S. DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERY AND WILDLIFE





THE THREATS

Legion flights of waterfowl once darkened the sky in spring and fall. But no more. More than half the nesting range of ducks in the prairie pothole country of the United States has been destroyed by drainage, and the ducks and all Americans have lost as a result.

Much of the prairie pothole country was put to the plow shortly after the Civil War. Between 1870 and 1930, farm crops followed the ditch and tile into those wetlands which were the easiest and cheapest to drain. The trend was temporarily reversed in the 1930's when one of the severest drouths in history caused us to hoard our precious water supply. Following World War II, the impetus for record crop production from every acre brought drainage into the pothole country in gigantic proportions. Many more thousands of wetlands acres faced permanent, man-made drouth for the first time.

Drainage was not the only threat facing wetlands and waterfowl. New highway construction created ditches into which feeder canals from the nearest potholes could be channeled. Watershed districts, organized to conserve soil and water resources, quite often were nothing more than drainage districts, with public funds once again used to destroy wetlands, a public resource.



Open ditch drainage is the major threat to wetlands



*Siltation
as a
result of
erosion
destroys
many
wetlands*

Poor land use, too, contributes to the steady dwindling of our wetlands. Many remaining potholes are surrounded by tilled fields where the absence of cover crops, soil fertility and crop rotations cause rapid erosion of topsoil into the potholes. Unfortunately, undue sedimentation will kill a pothole as surely as will a drainage ditch.

Drainage ditches, single-purpose highway construction and watershed projects, siltation, pollution and other causes all destroy wetlands. If the trend continues, all of the prairie wetlands will be gone in a few years. In creating this permanent drouth, man is also destroying a great natural heritage. By permitting this to happen, he must shoulder the responsibility forever.

*Urban expansion is
taking its toll*





THE PRESERVATION

The cause and effect of the "Dirty Thirties" reawakened the conscience of many Americans to the realization of just how destructive this nation had allowed itself to be with its once-rich gift of natural resources. J.N. "Ding" Darling and many other conservationists repeatedly called attention to our abuse of our wetlands. Studies by the Fish and Wildlife Service in the late 1940's gave graphic evidence of the massive destruction of wetlands and signalled the need for immediate constructive action.

This action took several forms: restricted hunting seasons, particularly on those duck species most critically hurt; programs to better protect brood stock; efforts to slow down the massive drainage program; and action to reserve and replace wetlands for waterfowl.

*Privately owned wetlands
are valuable for purposes
other than wildlife*

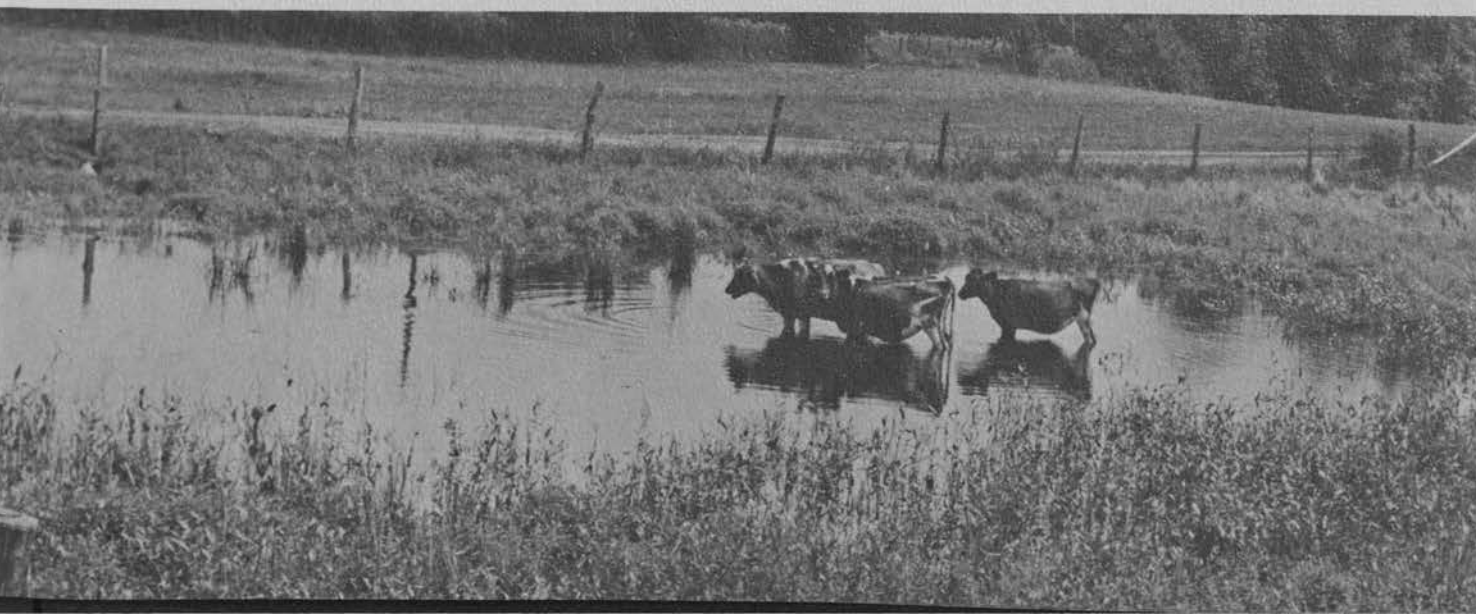
*Public ownership means
wetlands forever*

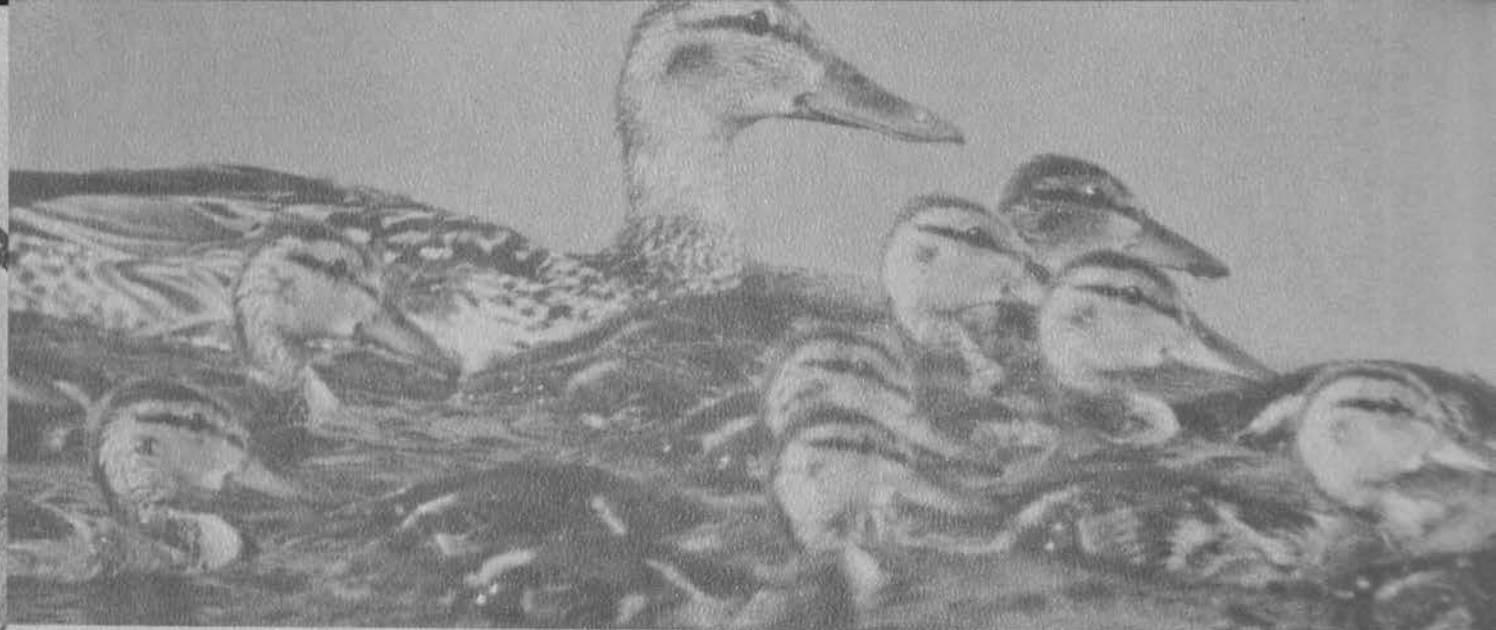
*The South Dakota Department
of Game, Fish and Parks has
a progressive wetlands
preservation program*

The alarming facts disclosed by the Service's studies brought widespread support for public acquisition of wetlands. Congress responded in 1958 by amending the Duck Stamp Act to authorize outright purchase and long-term easements of wetlands. However, funds were inadequate until the 1961 Congress authorized, under the Wetlands Loan Act, a fund of \$105 million repayable from receipts of the future sales of Duck Stamps. Thus, the accelerated wetlands habitat preservation program began.

The program has two parts. The land acquisition program protects the larger, more permanent wetlands. In South Dakota, about 1,000 of these nucleus waterfowl brood areas will be in public ownership. Under the second part of the program, the smaller, temporary wetlands around the nucleus areas will remain in private ownership but will be protected by easement under which the owner agrees, for a single payment, not to drain, burn, fill or level his wetlands.

Although the federal wetlands program combined with the State of South Dakota acquisition program will give permanent protection to many wetlands, this is not the total answer. Continued public interest in and support for wetlands preservation is necessary.





OBJECTIVES

The goal of the national wildlife refuge system is to further a national program of fish and wildlife conservation by restoring, developing and managing habitat for migratory birds and other species of fish and wildlife. To accomplish this, the Bureau of Sport Fisheries and Wildlife will make full use of the refuge system's fish, wildlife, land and water resources.

An integral part of the national wildlife refuge system, the South Dakota waterfowl production areas will support the following objectives:

Preserve privately-owned wetlands through payments to their owners for their agreement not to burn, drain, fill or level these wetlands.

Provide, through preservation of these tracts, a base for coordinating local watershed and land use planning.

Waterfowl production is a primary goal

Public Waterfowl Production Areas Will:

Provide the most favorable conditions for duck production as is economically feasible.

Be developed and managed for unique and threatened plants and animals.

Provide a controllable area of land as a basic nucleus for natural resource planning by public and private organizations.

Be dedicated to better public understanding and appreciation of fish and wildlife conservation.

Be developed and managed for nature-oriented recreational opportunity.

Provide hunting opportunity for waterfowl, upland and big game.

Provide habitat for a variety of migratory birds and other wildlife.

Preserve and enhance natural beauty for its scenic and other esthetic values.

Preserve representative segments of unique habitat.

*Waterfowl hunting is a major benefit
of the wetlands preservation program*



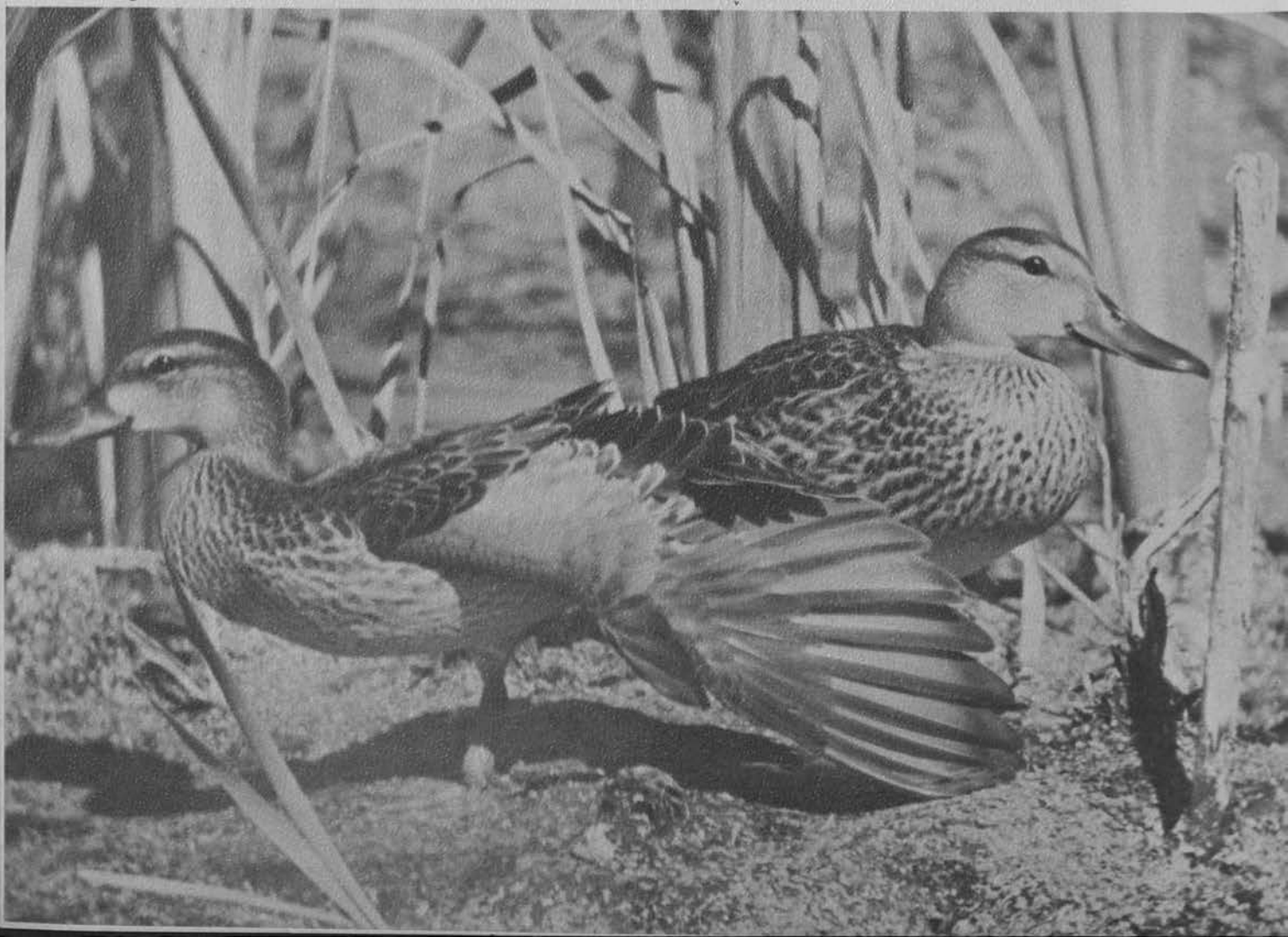


WILDLIFE

on publicly-owned waterfowl production areas

Public waterfowl production areas will be managed to provide the best possible conditions for wildlife, particularly waterfowl. The areas will be popular to persons interested in hunting, bird watching and sightseeing, because of the great variety of land and water birds and other wildlife present on these wetlands.

*Blue-winged teal are the most common
nesting ducks on South Dakota wetlands*





Waterfowl

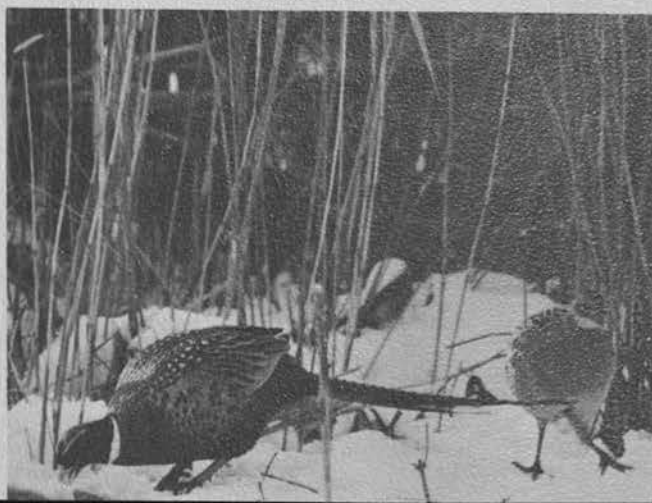
The most common ducks nesting on the publicly-owned waterfowl production areas will be blue-winged teal, mallards and pintails. These species are high in demand and mallards and pintails usually rank in the top five of the hunters' bag in the Central Flyway. It will be our primary goal to provide duck production habitat for these species. Food, water and cover also will be provided for migrant waterfowl.

*Waterfowl
broods need
food, water
and cover*

Other Birds

Marsh and water birds will be common residents. These are birds which provide many hours of enjoyment to the nature lover. Management of the marsh areas for waterfowl will improve conditions for these species.

Pheasants and Hungarian partridge will also be found on the publicly-owned areas. The planting of food patches and re-establishment of native grasses are practices which will benefit upland birds. The increased game populations will provide greater opportunity for observation by the public and better days afield for hunters.



*Pheasants utilize
waterfowl production
areas extensively*

*Prairie wetlands
often provide
the only cover
for white-tailed
deer*



Mammals

White-tailed deer, common to the prairies, frequently will be found on waterfowl production areas. In the prairie pothole country, deer make heavy use of wetlands areas year around, providing an added bonus to the wildlife observer and the hunter.

The public will be able to enjoy rabbits and other furbearing animals in their natural surroundings. Muskrats will generally improve waterfowl habitat, as will beavers, but both require control when they damage dikes and other water control facilities. Other furbearers are raccoon, weasel, skunk, fox and badger. Public harvest of these species in accordance with state law may be permitted.

*Furbearers,
common to the
wetlands,
provide both
recreation
and income
to the public*



RECREATION

on publicly-owned waterfowl production areas



The publicly-owned waterfowl production areas in South Dakota will have much to offer in the way of waterfowl, marsh and water birds, a variety of wildlife and interesting wild lands. For public enjoyment and understanding of these resources wildlife management demonstration areas will be established on several production areas scattered throughout the pothole area.

With careful planning, the demonstration areas can provide nature-oriented public use without impairing the production of waterfowl. On non-demonstration areas, recreational facilities will be limited with the natural capabilities of the areas providing the recreational opportunity.

Picnicking

Picnicking can be part of a day's visit to waterfowl production areas. Picnic areas will be developed on the demonstration areas for group or family picnics. Picnicking will be welcomed on other areas, but no facilities will be provided.

*Wetlands and wildlife can be
enjoyed by the entire family*





*Wetlands are
wild places
where youth
can make
discoveries*

Nature Interpretation

Wildlife management demonstration areas will be developed to stimulate an appreciation and understanding of nature by persons of all age groups. This will be done by developing nature trails and interpretive signs and displays where visitors can view and understand the living wetlands community they are visiting. Educational techniques also will be used to show the role management plays in the preservation of such areas.

Sightseeing, Nature Study and Photography

The wildlife using these demonstration areas and the native plants present on them will attract many visitors. To assist the visitors in enjoying these areas, observation towers, photography blinds and trails will be constructed, enabling them to observe and study plants and animals in their natural environment.

*Wetlands are outdoor
classrooms for students*



Waterfowl Hunting

Publicly-owned waterfowl production areas will help fill a need where public hunting areas are in demand. They will distribute waterfowl so that a larger number of people can enjoy the sport of wildfowling. The success of a hunting program will depend upon the attractiveness of the areas to waterfowl.

Upland and Big Game Hunting

Although the areas will be managed primarily for waterfowl, other wildlife species will also benefit. Pheasants will increase with development and should be utilized by the public through quality hunting programs. In addition to pheasants, Hungarian partridge, rabbits and white-tailed deer may be hunted during established state seasons.



*Purchased
waterfowl
production
areas offer
hunting
action*

LAND AND WATER RESOURCES

on publicly-owned waterfowl production areas

Marsh and Water

Natural water areas will be supplemented by constructing small check dams on existing drainage-ways to create additional water areas, filling existing drainage ditches to restore drained wetlands, and blasting or bulldozing pot-holes.

These areas will provide additional sites for waterfowl breeding, brood waters and migration rest and feeding areas.

Uplands

Lands under cultivation at the time of acquisition usually will be seeded to a permanent grass cover to provide adequate nesting cover to waterfowl and other game as well as to prevent wind and water erosion. Some small patches of cropland will be maintained to furnish foods to upland game birds and other wildlife. Wooded areas will be maintained to provide for a balanced wildlife community.

Fencing of upland areas will be required to provide adequate protection and to utilize cattle grazing as a management tool in grassland areas. Control of noxious weeds may also be necessary.

Fencing is generally a must for adequate protection



BENEFITS

Development and management of publicly-owned waterfowl production areas will contribute to the conservation of the national migratory bird resource, afford more public enjoyment of waterfowl and other wildlife, and stimulate the local economy. Management will return both tangible and intangible benefits to the state and its economy.

Hunting opportunities for waterfowl, upland and big game will be offered.

Hunter success on private lands will improve as a result of wildlife populations on waterfowl production areas.

A major industry in South Dakota is pheasant hunting which contributes millions of dollars annually to the State's economy. Wetlands provide much of the pheasants' basic needs which in turn supports this important source of revenue.

COSTS

The following is a breakdown of the estimated cost of developments needed for the proper protection, management and recreational use of 1,000 waterfowl production areas purchased by the federal government.

The installation of these developments will be phased over a 15-year period beginning as soon as possible.

Water facilities	\$ 600,000
Biological development	600,000
Fencing	1,000,000
Posting	100,000
Recreation	300,000
	\$2,600,000

Created in 1849, the Department of the Interior -- America's Department of Natural Resources -- is concerned with the management, conservation, and development of the Nation's water, fish, wildlife, mineral, forest, and park and recreational resources. It also has major responsibilities for Indian and Territorial affairs.

As the Nation's principal conservation agency, the Department works to assure that nonrenewable resources are developed and used wisely, that park and recreational resources are conserved for the future, and that renewable resources make their full contribution to the progress, prosperity, and security of the United States -- now and in the future.



"For centuries Americans have drawn strength and inspiration from the beauty of our country. It would be a neglectful generation indeed, indifferent, alike to the judgement of history and the command of principle, which failed to preserve and extend such a heritage for its descendants."

Lyndon B. Johnson



A PLAN FOR

AGASSIZ

NATIONAL WILDLIFE REFUGE

Marshall County, Minnesota



CHARLES W.
SCHWARTZ



Agassiz National Wildlife Refuge is but a facet of the National Wildlife Refuge System which is dedicated to the preservation and management of wildlife for the enjoyment and enrichment of the American people.

The National Wildlife Refuge System represents the most far-reaching and comprehensive wildlife resource management program which has been applied to the land in the history of mankind. Units of the System are found on lands reaching from the shores of the Arctic Ocean to islands of the Central Pacific Ocean and from the Florida Keys to northern Maine.



AGASSIZ

NATIONAL WILDLIFE REFUGE

U. S. Department of

the Interior, Bureau of Sport Fisheries and Wildlife



THE PAST

Agassiz National Wildlife Refuge is a paradox—both a symbol of man's striving to bend nature to his will and his compassionate effort to restore a part of his environment to its natural state.

The desire to dominate the environment came first. Located on a small bay of prehistoric Lake Agassiz, the present refuge area was once composed of a vast lowland forest and grassland with a scattering of hardwood groves, lakes and potholes.

Before white man came, the area abounded with wildlife. The lakes and small potholes teemed with waterfowl and shorebirds. The grasslands and wooded areas harbored large numbers of ruffed grouse, prairie chicken, moose, bear and elk. Beaver, mink, muskrats, otter and other furbearers were common along the waterways.

With white man came change. Fur trappers moved in, taking beaver from the streams. Then settlers, pushing the Indian and his way of life aside, changed the land, too. Virgin sod was broken by the plow, the forests were cut and burned. Then the settler challenged the land itself.



THE REFUGE PURPOSE

Goal of the national wildlife refuge system is to further a national program of fish and wildlife conservation by restoring, developing and managing the environment for these wild creatures, and to encourage public enjoyment of them.

As part of this great national effort, Agassiz National Wildlife Refuge will support the following objectives:

Provide as near optimum conditions for duck production as feasible.

Manage lands and water to benefit migrant waterfowl and other wildlife, considering the effect on adjacent public and private lands.

Develop and manage habitat to enhance the survival of rare and endangered species.



Dedicate Agassiz Refuge to promoting better understanding and appreciation of man's natural environment by providing a wild-life-oriented recreation program.

Provide a controllable nucleus of land for natural resource planning, including watershed planning, by public and private organizations.

Continue to provide habitat suitable for perpetuation of a Canada goose breeding flock.

Develop and manage habitat to maintain desired populations of big game and furbearing animals, upland birds, marsh and water birds.

Conserve and enhance, as feasible, the natural beauty of the total refuge environment.



WILDLIFE

Agassiz National Wildlife Refuge with its wild lands is one of this nation's great wildlife areas. Its magnificent marshes teeming with marsh and water birds, furbearers, deer and moose will not only be a great producer of wildlife when fully developed, but an area where the opportunity to see and study wildlife will be unparalleled.

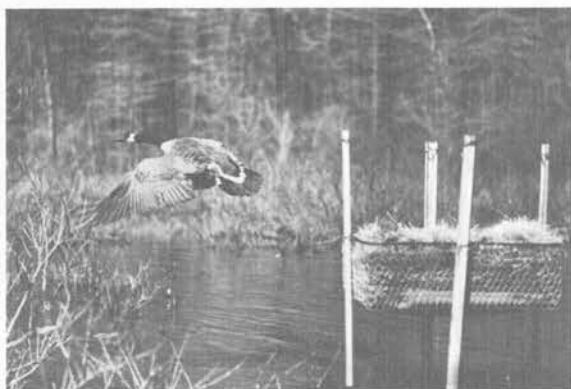
Ducks

Duck production has the highest management priority on the refuge. At times the duck production per acre is equal to or even surpasses the prime duck breeding regions of the prairie pothole country. Through proper management and more intensive development of existing lands and waters, the refuge may produce 50,000 ducklings per year, mainly blue-winged teal, mallard, gadwall, ring-neck, redhead, and ruddy ducks.



Geese

The earliest naturalists who visited the refuge area reported flocks of Canada geese with young. Nest robbing, market hunting and use for food caused these birds to disappear and as man changed the landscape, they no longer nested. Later, a small resident breeding flock was re-established on the refuge. The goal now is to produce at least 2,000 young annually. These trophy birds are in high demand by hunters and provide aesthetic viewing and educational opportunities.



Swans

Whistling swans are seen frequently during the spring and fall migration periods. The use of the refuge by these stately, large, white birds will be encouraged. In addition, the rare trumpeter swan will receive special consideration. Originally, Agassiz Refuge was part of this magnificent bird's breeding range. It is believed that through careful planning and management, the trumpeter swan can be re-introduced to Agassiz and successfully established there as a breeding bird.



The welfare of rare wildlife species is of national interest and trumpeter swan or any other rare, endangered or threatened species that requires special management practices to aid their survival will receive consideration.





Other Birds

A visitor to this region in 1885 observed a wealth of bird life. Phalaropes, yellow-legs and other shore birds were present in huge flocks on sloughs and potholes. Wilson's snipe, plovers, and song birds were numerous. Ruffed grouse and sharp-tailed grouse were common. These birds are still found on the refuge. One objective is to develop and manage habitat for public enjoyment of the widest variety of bird species.





Furbearers

The variety of furbearing animals amazes even the most experienced naturalist. An evening drive through the refuge may present the opportunity to see foxes, mink, bobcats and other secretive animals. All furbearing animals will be managed to provide an ecological balance between population numbers and habitat and between predator and prey. At times additional control may be necessary where muskrats and beaver are causing damage or interfering with water management. Reducing mink, raccoon, skunk, fox and coyote numbers may be necessary on selected areas during the waterfowl nesting season to increase waterfowl production. Lynx, bobcats, bear, and timber wolves will be protected for public enjoyment unless individual animals warrant removal.



Big Game

Nothing quite compares with the breath-taking view of a moose charging out of the marsh, brushing aside all that is before him. The visitor's unique experience of seeing moose will be encouraged by maintaining suitable range for a maximum herd of 125 moose. No special management is planned since these animals capitalize on habitat created for waterfowl, though sufficient woody browse will be maintained. When state regulations permit a moose hunt, a limited harvest will be allowed as a management tool to control population growth. The herd size presently numbers about 180.





White-tailed deer provide an enormous amount of public enjoyment to sightseers and hunters. A healthy white-tailed deer herd will be maintained in sufficient numbers for public enjoyment. The herd will be kept in balance with its habitat by public hunting. The hunting will be in accordance with state regulations.



LAND AND WATER

Traveling through Agassiz Refuge, the visitor is struck by the immense wilderness around him. As he drives or hikes across it, he feels adrift on an endless sea of undulating marsh grasses, broken only by fingers of rippling waters dotted with scattered tree-covered islands. Wildlife abounds in this seemingly pristine area which, in reality, is intensively managed land and water. The development outlined in this plan will further improve this great wildlife area for the American people.

Croplands

Farming for wildlife is a common practice on wildlife areas and at Agassiz Refuge about 1,200 acres are under cultivation. The purpose is to provide food for waterfowl during a time when their presence on private lands can be detrimental. The present program is adequate so long as surplus grain is available. If not available, more intensive grain farming may be necessary. This can be accomplished by improving the croplands through approved soil and moisture conservation practices.



Forest Lands

In early days heavy demands were made by settlers for spruce, tamarack, aspen and birch for building-logs, lumber, shingles, lath and pulpwood. Devastating fires at the turn of the century further depleted the forest. Its recovery has been slow.

The present forest will be managed for deer, moose and ruffed grouse. Controlled burning, planting and timber stand improvement will be used to improve the forest for wildlife. The same management tools will be used to manage the brush land for big game.

A portion of the spruce-tamarack forest will be retained in a natural state. This undisturbed bog habitat, including two bog lakes with associated plant and animal communities, represents one of the most westerly extensions of spruce-tamarack in the contiguous 48 states. Preservation of this area will maintain the beauty, integrity and stability of a unique biological community for future generations to enjoy.



Grasslands

About 20,000 acres of grassland will be managed as nesting cover for waterfowl, and food and cover for sharp-tailed grouse and prairie chickens. Special emphasis will be given to the preservation of booming and strutting sites of the endangered prairie chicken and to provide adequate food and cover during nesting periods and the critical winter season.

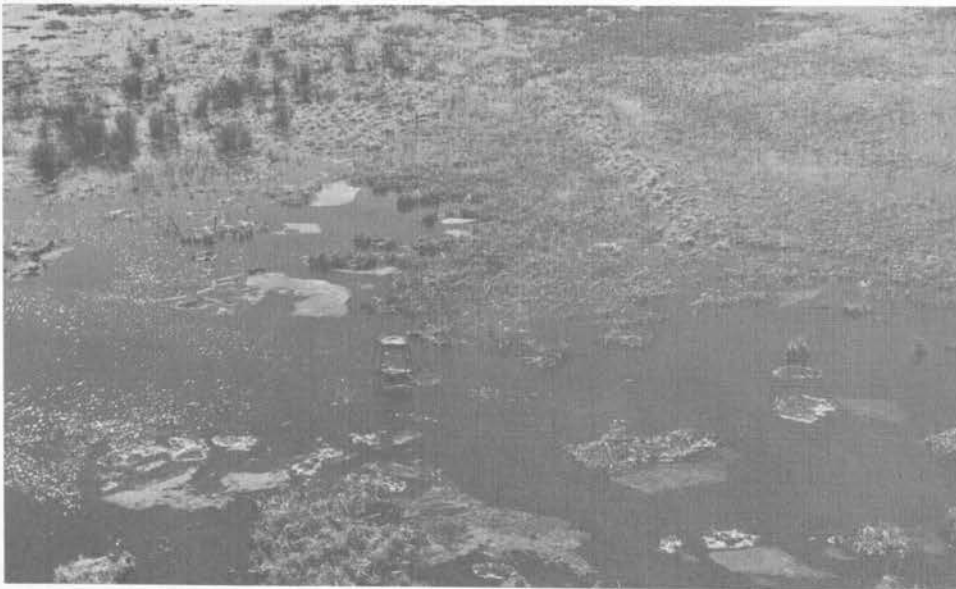
Grasslands will be managed for waterfowl primarily by cattle grazing, mowing, burning and chemical control. Improvements needed for proper management will include fencing, corrals, trails, brush clearing, seeding and drainage. Stock ponds, which serve as both cattle watering holes and duck nesting territories, will be constructed on the grassland areas.



Wetlands

The primary need of waterfowl on Agassiz Refuge is improvement of nesting habitat. The most economical method of improving or creating nesting habitat is construction of potholes and artificial nesting sites. Some 20,000 acres of lowland are suited to pothole development. In areas where the ground is subject to flooding, the potholes will be dug by machine and the spoil leveled to provide nesting sites. In other areas, the potholes will be created by blasting.

More than 20,000 acres of the existing marsh will be improved by construction of dikes, water control structures, level ditching and installation of nesting structures. The marsh will be subdivided into 27 separate management pools. These pools will be managed on a rotation of drawdown and flooding so that a desired amount of good habitat can be maintained on a sustained basis. Controlled burning may also be used as a management tool.



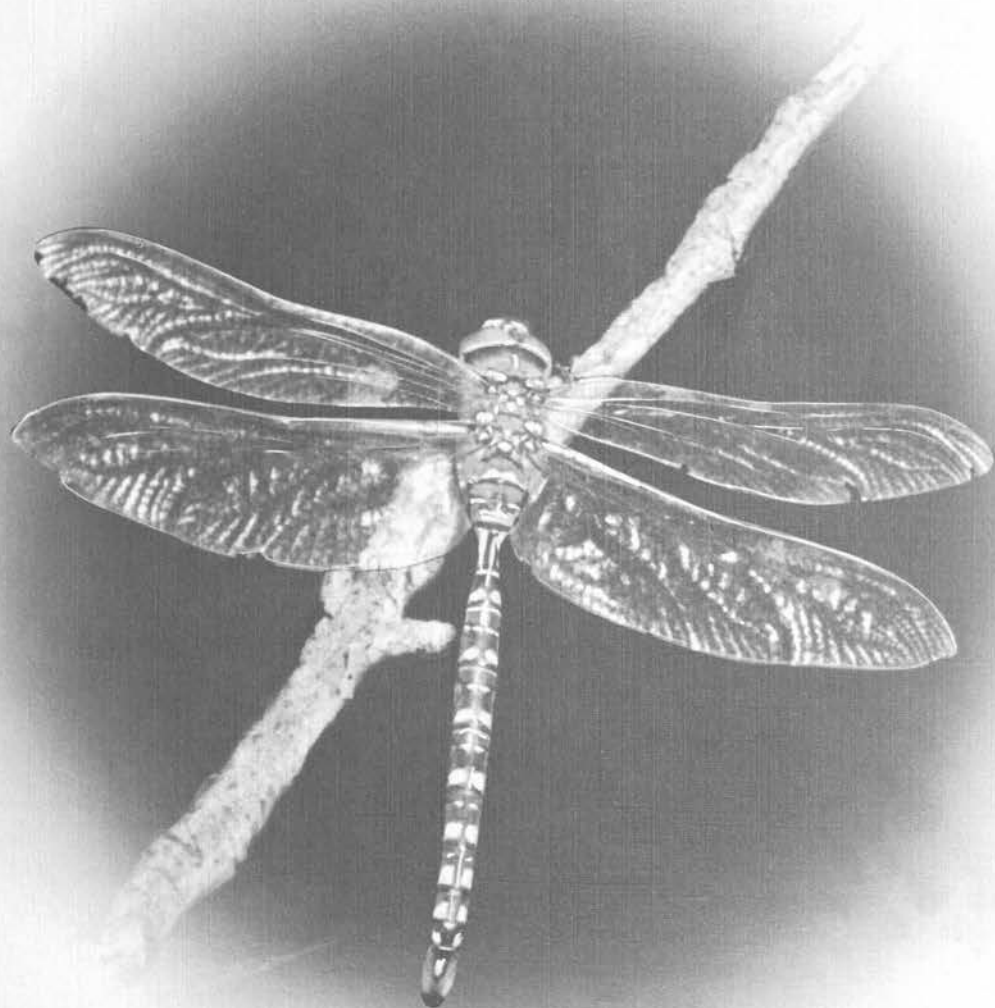
LAND, WATER AND MAN

Man's relationship to his environment is a complex alliance. Knowledge of the land and water as part of his total environment enables man to better understand this alliance.

Agassiz Refuge is a living example of man's impact on nature — the consequences of agricultural drainage on the natural scene and on wildlife, the peat fires and the resulting changes, and the reflooding for wildlife. The refuge interpretive program will build on this living example to help people better understand the changing world around them and the factors that alter it.

Future development and management of the refuge will consider the effect of any change on the total refuge environment. If alteration of the landscape is required, it will be done with natural beauty given primary consideration.





PUBLIC USE

A visit to Agassiz Refuge, remote from the cross-country routes of the tourist and the crowded world of the urban dweller, is akin to a vision of the days of old. An early morning or evening hike or drive along its rough unimproved roads will delight even the most sophisticated with its unmatched variety and amount of wildlife. Though the refuge is not readily accessible to the public at the present time, a future goal is to provide an opportunity for the public to see and learn about wildlife on a managed area. Thus, the visitor may gain a better understanding and appreciation of the contributions of wildlife and its relation to man.

Wildlife Interpretation, Sightseeing and Photography

The refuge has much to offer the public in the way of impressive waterfowl concentrations, variety of other migratory birds, white-tailed deer, moose and interesting wildlands. Ecologically, it is a living museum of native plant and animal communities found in a natural state which can, if preserved, excite and educate generations to come.

Access to this wildlife paradise will be via a self-guided auto route laid out on the road dike system. Turn-outs and interpretive signs will allow unhurried appreciation and understanding of wildlife and wildlife management. Occasionally, the route will be changed to take advantage of seasonal attractions and highlights. Interpretive signs will explain the natural characteristics of the refuge and stimulate people to learn more about their environment.



Other interpretive media will be housed in the Interpretive Center where audio-visual programs can be presented to youth and adult groups. Conservation workshops and meetings will take place here. The Center will be the starting point for the interpretive trails, both foot and auto, and the focal point for the refuge wildlife interpretive program.

Observation towers, photography blinds and interpretive foot trails will assist the visitor in enjoying representative sections of the marsh, woods and grasslands and in observing and studying plants and animals in their natural surroundings.

Picnicking

Picnicking on the refuge will be part of a day's visit, and a picnic area will be developed near the Interpretive Center.

Camping

Except for specialized groups such as Boy Scout Camporees, overnight use, particularly camping, will not be provided. Private interests will be encouraged to provide for overnight accommodations adjacent to the refuge.



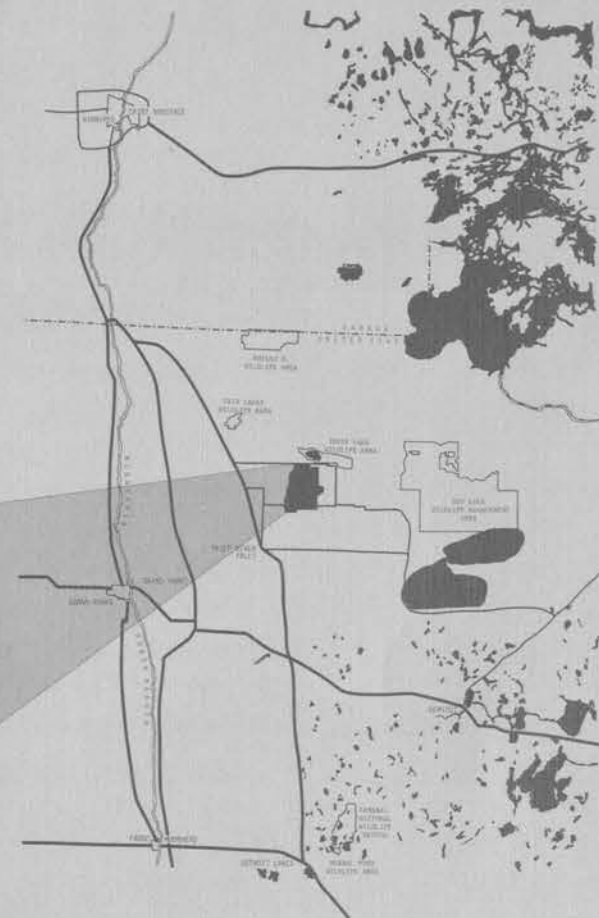
AGASSIZ

NATIONAL
WILDLIFE
REFUGE



PROPOSED DEVELOPMENT

- | | | | |
|---|------------------|---|--|
|  | WATER |  | OFFICE —
INFORMATION |
|  | DIKE ROADS |  | WATER
STRUCTURES |
|  | PUBLIC ROAD |  | WILDLIFE
INTERPRETIVE
AUTO DRIVE |
|  | REFUGE BUILDINGS | | |



Hunting

Agassiz Refuge, operating in conjunction with the Minnesota Conservation Department's Elm Lake and Eckvold Wildlife Management Areas, provides excellent waterfowl hunting. Feeding and resting areas provided by the refuge help to attract waterfowl and to hold them for a prolonged hunting period, while the adjacent State areas provide the space and habitat required by the hunter. As the needs of waterfowl change and the concepts and techniques of waterfowl management become more refined, waterfowl hunting on the refuge may become a reality.

Although the refuge will be managed primarily for waterfowl, other wildlife species also will benefit. Species such as deer and moose have increased in number with development of the refuge and should be utilized by the public through high quality hunting programs. Hunting opportunities will be offered during established state seasons and during periods when hunting activities are in balance with the refuge waterfowl program. Other species that may be hunted on the refuge are ruffed grouse and rabbits.



ROLE IN THE COMMUNITY

Americans are continuing to turn to the outdoors for recreation, relaxation and other rewarding uses of their leisure time as never before. The activities they choose and enjoy take many forms. Three of the outdoor recreational activities that are most popular are walking, driving for pleasure and sightseeing. These activities are the ones being emphasized on the refuge. Provision is being made now to insure that Americans of this and future generations shall have access to Agassiz Refuge. By utilizing the outdoor recreation provided by the refuge, other agencies and organizations can develop broader outdoor recreation plans and programs—knowing that the refuge is offering a nucleus for these.

By maintaining a high-quality wild area and providing an opportunity for people to visit and enjoy it, the refuge plays an important role in northwestern Minnesota's economic, aesthetic and recreation programs. With increased leisure time and money, more and more people will be interested in a weekend drive to visit a wildlife area such as Agassiz. Thousands of people are expected to visit the refuge annually. These visitors, along with hunters, can be expected to spend considerable money in the local area. Combining this with the direct return to the county from the Refuge Revenue Sharing Act, there will be a substantial annual return to the local economy.



The refuge is an important part of the Thief-Mud River Watershed. This plan recognizes the inter-relationship of the refuge's operation with the entire watershed. The refuge will continue to operate its water controls in the public interest with a primary responsibility to waterfowl.

The refuge, by releasing water throughout the winter will create a storage capacity in early spring. Storage of spring flows will begin once the downstream channel capacity is reached and will be continued until maximum refuge storage capacity is reached. The stored flood waters will be discharged following passage of the flood peak. Sufficient water will be retained to provide for waterfowl habitat. This operation adequately protects the government's interest in dikes and control works, provides for management of waterfowl areas and provides a base from which broader watershed management plans can be developed.

While there are several tangible benefits, there are also important intangible benefits that cannot be measured in dollars. Wildlife has values that are real but intangible, cherished primarily for aesthetic reasons; and, as man becomes more aware of his environment and the need for wild areas and wildlife, Agassiz Refuge's greatest value to man and northwestern Minnesota will be its aesthetic contribution.





OPERATIONS

Many of the present refuge facilities are inadequate or need major rehabilitation. The entire dike and road system must be rebuilt and new dikes and water control structures are needed. All of the service buildings must be replaced at a new site. Buildings used for staff housing are inadequate and need replacement. Maintenance equipment is military surplus and should be upgraded. These improvements, plus a permanent staff of eight, are necessary for efficient refuge operations and to meet public needs for services.



COST

The cost of the development outlined in this plan totals \$4,645,000. Water facilities improvement will cost \$2,132,000, with biological development costing \$1,360,000, buildings costing \$396,000, roads and trails \$450,000, structures and utilities \$163,000, fencing and posting \$63,000 and public use facilities \$81,000. An additional \$400,000 is needed for detailed site planning and design.





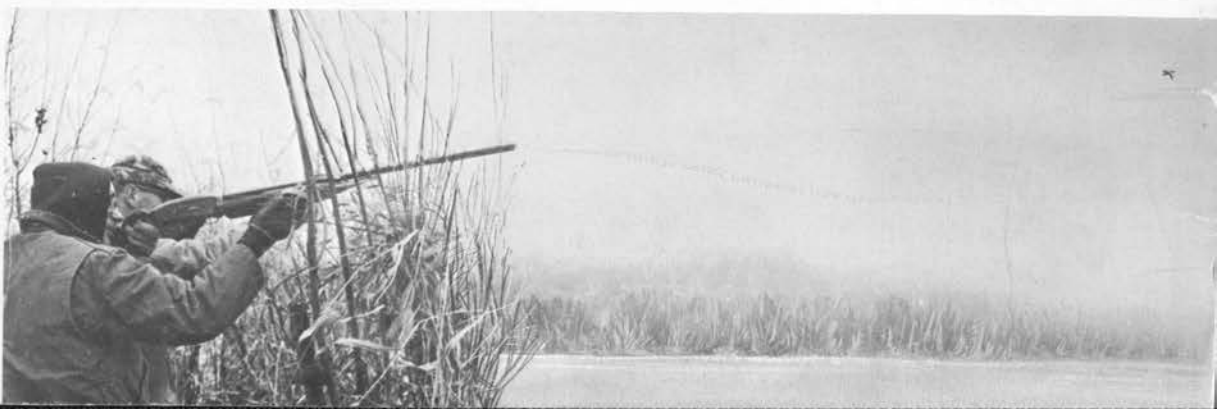
Created in 1849, the Department of the Interior—America's Department of Natural Resources—is concerned with the management, conservation, and development of the Nation's water, fish, wildlife, mineral, forest and park and recreational resources. It also has major responsibilities for Indian and Territorial affairs.

As the Nation's principal conservation agency, the Department works to assure that nonrenewable resources are developed and used wisely, that park and recreational resources are conserved for the future, and that renewable resources make their full contribution to the progress, prosperity, and security of the United States—now and in the future.



A PLAN FOR

Upper Mississippi River WILDLIFE AND FISH REFUGE



Iowa
Illinois
Minnesota
Wisconsin



This plan describes the Upper Mississippi River Wildlife and Fish Refuge, its goals, and proposals for the future. The plan also provides general guidance for the physical improvement and biological management of the refuge for the benefit of the wildlife resource and for the people of the Nation.

The refuge is a facet of the National Wildlife Refuge System which is dedicated to the preservation and management of wildlife for the enjoyment and enrichment of the American people.

The National Wildlife Refuge System represents the most far-reaching and comprehensive wildlife resource management program which has been applied to the land in the history of mankind. Units of the System are found on lands reaching from the shores of the Arctic Ocean to islands of the Central Pacific Ocean and from the Florida Keys to northern Maine.



Upper Mississippi River WILDLIFE AND FISH REFUGE

U. S. Department of the Interior, Bureau of Sport Fisheries and Wildlife



The Upper Mississippi River offers a rewarding use of leisure time for millions of Americans.



THE PAST

Much of the history of man in the heartland of America has been fashioned by the mighty Mississippi River, one of the world's great waterways. This history began 13,000 years ago when Indians entered the upper valley to hunt.

These primitive people were succeeded by early nomadic tribes, by the more sedentary woodlands dwellers and, between 1300 and 1600 A.D., by the mound builders who left mysterious "effigy" mounds throughout the valley. By the 17th century, the Kickapoos, Sauk, Fox, Iowas, Ojibways and Dakotas had replaced the mound builders.

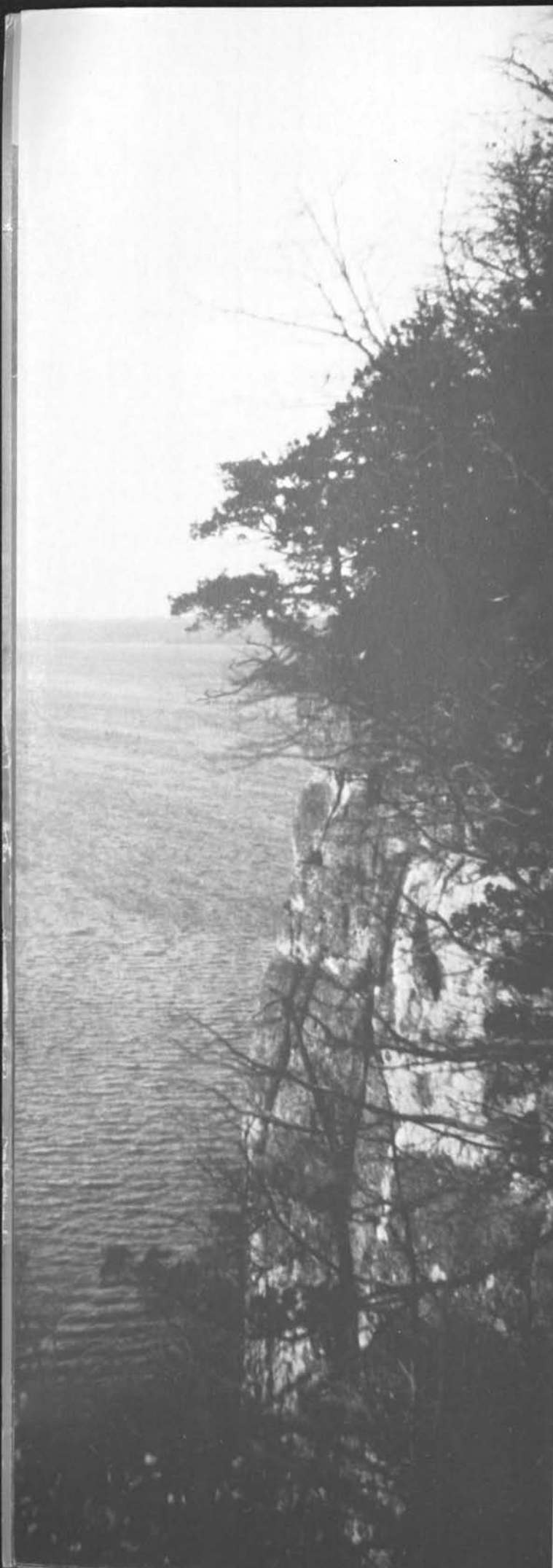
French missionaries and traders visited these tribes in the 1600's, laying French claim to the Louisiana Territory. By 1763, the British had gained control of the upper valley, only to lose it to the Americans in the early 1800's. Following the Blackhawk War of 1832, which subdued the tribes, settlers swarmed into the upper valley to farm, cut timber and build towns. By 1848, the local tribes were gone.

As farming, lumbering, mining and trade increased, the Upper Mississippi grew in importance as an artery of commerce. Cities and towns replaced the old trading posts and forts; modern highways and rail lines were laid atop the ancient trails. The river was made even more useful by a series of locks and dams.

Wildlife abounded; its presence assured early man's survival in this wilderness. Waterfowl, forest game and fish were an everyday part of the river dweller's life. Wildlife gave way to the advance of axe and plow and was nearly lost as man subdued the land.

Yet a part of the river's wilderness has been saved. The Upper Mississippi River Wildlife and Fish Refuge still offers great potential for a unique kind of recreation while at the same time preserving a major natural resource in its original wildness.

The river has an atmosphere of wildness that has existed for centuries. This feeling is vital to the quality of outdoor experiences Americans are seeking today.



THE PRESENT

Settlement of the Upper Mississippi Valley brought problems of improper land use and, later, pollution. The woodlands, wildlife and waters were threatened.

The people saw the need for protection and pressed Congress for action. On June 7, 1924, Congress established the Upper Mississippi River Wildlife and Fish Refuge, and authorized land acquisition. Land acquired by the Army Corps of Engineers for the development of a nine-foot deep navigation channel was added to the refuge by cooperative agreement.

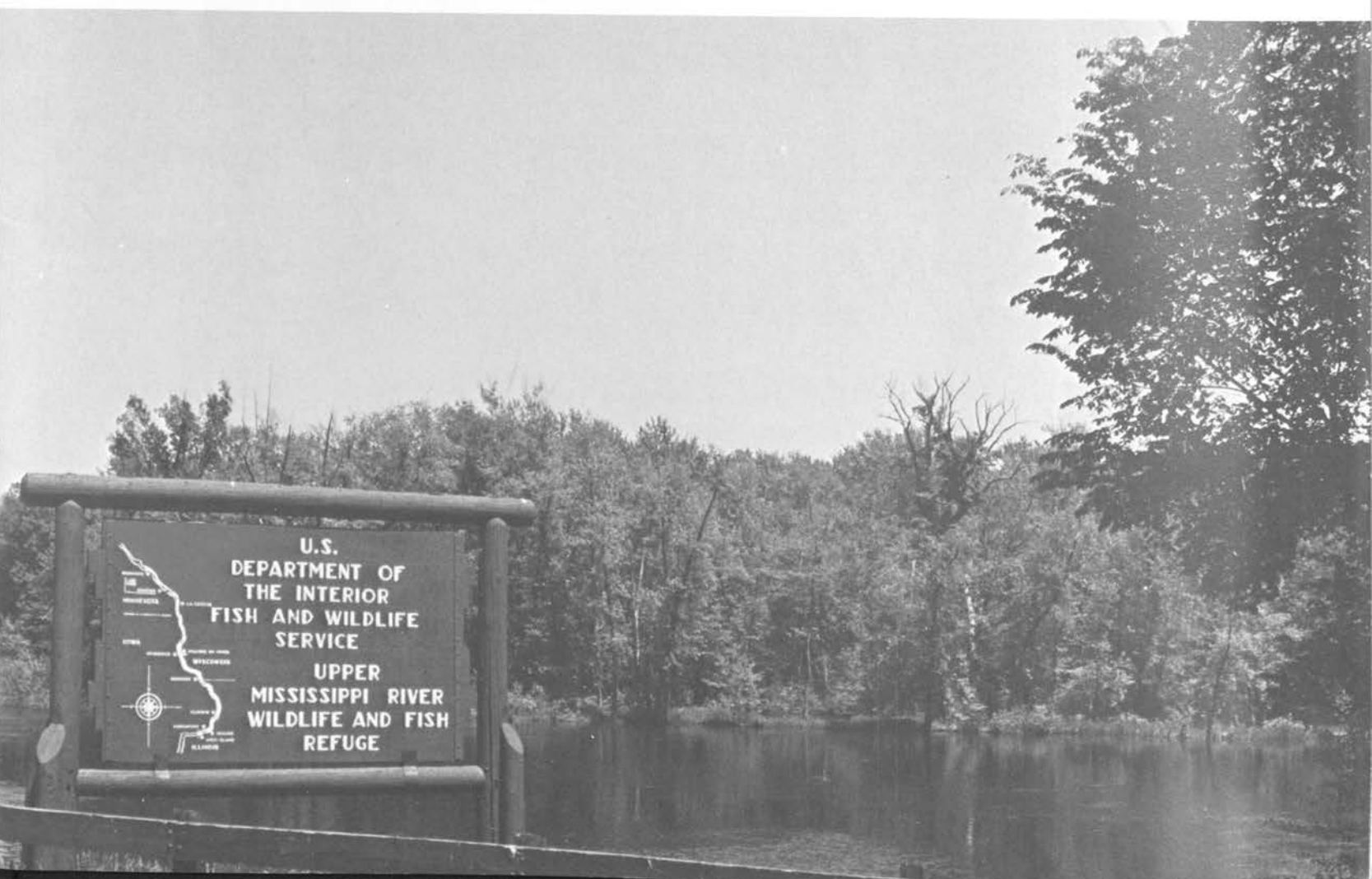
Today, the Upper Mississippi Refuge extends from Wabasha, Minnesota to Rock Island, Illinois, and contains 194,000 acres. This refuge area demonstrates that scenic, recreational and wildlife values can survive in competition with demands of a highly industrial society.

The character of the river varies from rock cliffs to broad expanses of open water.

Nature is never simple, and here on the river the relationships of plants and animals to each other and to their habitat are especially complex. Northern and southern life zones extend far beyond their normal boundaries in this river valley. More than a thousand varieties of plants, trees and shrubs, 113 kinds of fish, 270 species of birds, and 60 forms of mammals mingle here. Marshes, woodlands and sandy grasslands provide varying wildlife habitat. The valley's great cliffs, the carpet of woodlands, the marshes, the wildlife and the broad river channel are much the same as when they were seen by wandering Indians a thousand years ago.

In this great river refuge wilderness, man can once more travel the waterways, hunt and trap wild game, fish and enjoy this living river world.

Since 1924 the Upper Mississippi Wildlife and Fish Refuge has been a guardian of the river and its resources.





OBJECTIVES

The goal of the national wildlife refuge system is to preserve, restore and manage wildlife environments for the continued enjoyment and benefit of the American people.

Upper Mississippi River Wildlife and Fish Refuge is managed to meet the following objectives:

To preserve the wildlands character and natural beauty of the river bottoms, with the unique habitat and wildlife intact, and to foster an understanding and appreciation of this resource by providing for recreation and an educational experience as a part of that recreation.

To provide protection for rare and endangered species of fish, wildlife and plants, including the rare bald eagle; to promote the production of wood ducks; and to assure the continuation of an environment beneficial to migratory and resident wildlife.

To provide hunting and sport fishing opportunities on refuge lands, at the same time emphasizing the proper use and perpetuation of the wildlife resource.

The Upper Mississippi Refuge is spacious and much of the year untrampled by people, yet millions live within a day's drive.



BASIC ISSUES

The use and development of past years along the river have given rise to a number of basic issues which have and will have important repercussions on existing and future uses of the Mississippi River. Among some of the more important problems associated with the river at present are pollution, siltation, flooding and improper land use. The proposed twelve-foot navigation channel is an important future consideration. Highlights of these issues are discussed in more detail below.

Flooding

Annual flooding of the refuge can be expected. In recent years, severe spring floods have put virtually all refuge lands under water. In the future, floods may be even more severe because the flood plain is being restricted by filling for industrial development and by diking to protect cities and towns.

This history of flooding of refuge lands severely limits development of any major recreational or wildlife facilities and dictates that any facilities be substantial and adequately protected against flood damage.

Flooding, an unavoidable fact of life along the river, limits opportunities for developments.



Pollution

The river, which has nurtured the cities and towns along its course, also serves to remove their municipal and industrial wastes. In spite of efforts to curtail this abuse of the river the situation is critical. Only a combined, concerted effort by government, agricultural interests, industry and a committed citizenry can overcome this insidious problem and prevent the slow suffocation of the river and the creatures who live on it.



A polluted river can kill the creatures that live on it. These oil-coated ducks are victims of oil-polluted waters.

Siltation

Silt brought from throughout the Upper Mississippi watershed has changed the river. Many sloughs, ponds and marshes have filled with silt. The muddy water in the silt-laden ponds stirred by currents, wind action and bottom-feeding fishes, is no longer good habitat for waterfowl and fish. Siltation requires continuous dredging to maintain the present nine-foot-deep navigation channel. Channel straightening on tributary streams adds to the problem. Although the Corps of Engineers cooperates fully with conservation agencies, the disposal of dredged material is a major problem. Disposal areas are limited and alteration of valuable wildlife habitat is inevitable.

Siltation is a result of poor land use practices on the watersheds. Wise and complete watershed planning to overcome the problem is the first step toward the restoration of a silt-free, life-sustaining river.



Privately-owned shorelines are frequently misused. These valuable lands must be cleaned up if the river is to retain its recreational value.

Land Use

Near the river, improper use has blighted private lands, especially in and near communities. These communities must be encouraged to clean up and enhance values of river valley lands. More attention should be given to developing recreation facilities, including them as integral and valuable parts of the valley recreational program.

On government-owned lands, the demand for industrial and residential sites is constant and must be resisted if these publicly-owned lands and waters for wildlife and outdoor recreation are to be preserved. The Bureau of Sport Fisheries and Wildlife, in cooperation with the Corps of Engineers, has developed a zoning plan which recognizes these needs and accommodates them in a way that will interfere least with other uses.

Commercial Navigation

The Mississippi River has been man's way of moving goods ever since he first settled in its valley. The shifting, seasonal uncertainty of the stream was a serious problem until the late 1930's when the Corps of Engineers developed and began maintaining the present nine-foot-deep navigation channel. This major engineering feat involves many locks and dams and continuous dredging of the channel. Plans are now being made to make the channel 12-feet deep.

The 12-foot channel, designed for larger vessels, would be created by raising water levels or by making deeper water in the lock pools, or by a combination of the two. Whatever method is used, it will make a profound change in wildlife habitat along the river.

Dredging of a deeper channel will create millions of tons of additional sand and mud that will have to be pumped into disposal areas along the river.

This disposal of material dredged from the channel will, if properly placed, create sandbars for recreational use and improve fish and wildlife habitat. Improperly placed disposal will seriously harm marshy havens for waterfowl, valuable timbered islands and productive pool areas. A provision for protecting the present balance of natural resources and recreation areas must be part of any channel improvement project.

Huge 20,000-ton tows carrying cargoes of petroleum, coal and grain are common sights on this great artery of commerce.





A PLAN

FOR THE FUTURE

The Upper Mississippi River Wildlife and Fish Refuge is one of this Nation's greatest wildlife and outdoor recreation areas. If properly developed and managed, this segment of unspoiled river shoreline and islands can be preserved so that we, and those who follow, can enjoy the wildlife, wild natural beauty and recreational value of the river.

The following pages present a plan for accomplishing this goal.

The center-fold map shows a portion of the refuge developed and improved as proposed in this plan.



The great blue heron, sentinels of the river, are symbols of the tremendous variety of bird life present in the river valley.



Wildlife values, like these young red-tailed hawks, are of paramount value to the refuge.

WILDLIFE

This major wildlife refuge was established more than four decades ago to preserve the wildlife and vegetation of the river valley. Early management stressed the improvement of the area to benefit the then seriously threatened waterfowl which had for eons used the great river valley as a migration route twice each year.

"The waterfowl no longer face disaster", but the preservation of the unique vegetation, the native and migratory wildlife, and the basic recreational values of the refuge are still of great importance — importance that grows as the Nation's population grows and the need for wild things and wilderness experiences grows.

Wildlife and its habitat are inseparable and are the ingredients of the fundamental values that must be preserved. Specific plans for preserving and at the same time properly using and enjoying the resource follow. .

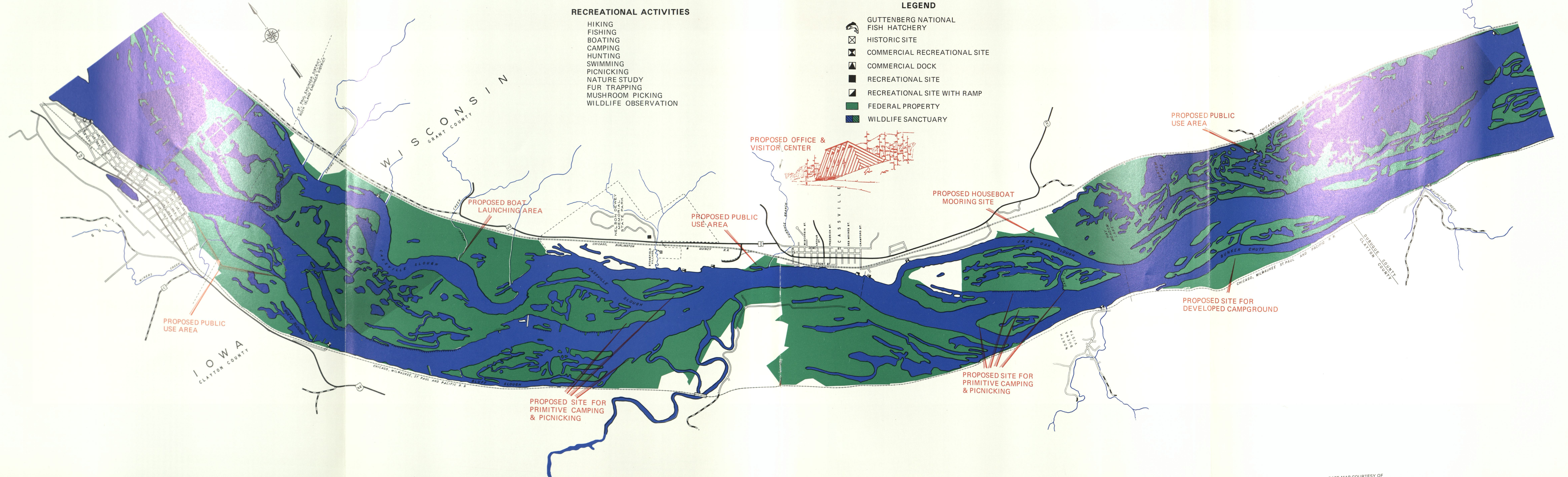
A 17-MILE PORTION OF THE UPPER MISSISSIPPI RIVER WILDLIFE AND FISH REFUGE (Total Refuge Length - 285 Miles)

RECREATIONAL ACTIVITIES

HIKING
FISHING
BOATING
CAMPING
HUNTING
SWIMMING
PICNICKING
NATURE STUDY
FUR TRAPPING
MUSHROOM PICKING
WILDLIFE OBSERVATION

LEGEND

- GUTTENBERG NATIONAL FISH HATCHERY
- HISTORIC SITE
- COMMERCIAL RECREATIONAL SITE
- COMMERCIAL DOCK
- RECREATIONAL SITE
- RECREATIONAL SITE WITH RAMP
- FEDERAL PROPERTY
- WILDLIFE SANCTUARY





Wood Duck

The spectacular wood duck is the most important species of waterfowl nesting on the refuge. Through the maintenance of valuable bottomland timber habitat and by providing artificial nesting sites when necessary, wood duck production will be emphasized. The objective is to raise 10,000 wood ducks each year.

Many wood ducks actually raised on the refuge are hatched in areas adjacent to the refuge. Survival of these young depends on the presence of ponds and food during the first several weeks of life. These habitat requirements will be provided on the refuge, where young wood ducks will have protection and seclusion that is essential to their welfare.

The unique and interesting habits of wood ducks highlight the experience of many refuge visitors.

Other Waterfowl

Another objective of refuge management is to provide a well-balanced program to benefit waterfowl and waterfowl hunters. This will be accomplished by continuing the current policy of making about 80 percent of the refuge available for waterfowl hunting. Carefully selected areas set aside as sanctuary are situated to make possible a worthwhile harvest without endangering the waterfowl resource as the birds migrate down the valley.

Waterfowl using the refuge must depend on natural foods; only 400 acres of cropland are available on the entire refuge. Manipulation of water levels — a technique normally producing large quantities of natural food — can be carried on only in a few places on the refuge. However, the locks and dams provide generally stable water conditions which promote the growth of large quantities of valuable waterfowl foods.



Widgeon are the most abundant species of waterfowl using the refuge during the fall migration period.



Bald Eagles

An outstanding attraction in the winter is the sight of bald eagles soaring over a frozen expanse of river. The bald eagle, our national bird, is endangered, and its very survival is now in question. Few eagles use the refuge in the summer, but they are a common sight in the winter when they congregate below the locks and dams and other open water areas to feed on dead or injured fish.

Eagles require protection and special roosting sites. Protection is assured on the refuge, where suitable roosting sites will be developed in the timberlands.

The stately eagle, virtual master of the skies, is extremely vulnerable to the invisible menace of pesticides, which concentrate in the fish that are the major food of the eagle. This underscores the need to work effectively to reduce the effects of pesticides on wildlife.



A family of squirrels explores the housing potential of a nesting box.

Upland Wildlife

Because of the nature of refuge lands there is little upland game habitat available. Pheasants and ruffed grouse occur in localized areas and on the margins of the refuge. Squirrels are common throughout. The observation and hunting of upland wildlife will be provided for wherever possible. In 1967 over 70,000 people hunted on the refuge.



Thousands of visitors come to the refuge to see wildlife. White-tailed deer quicken the heart of sightseer and hunter.

Big Game

White-tailed deer are the only big game animals found on the refuge. These animals are especially popular with visitors, who will be given every opportunity to observe them.

Carefully planned public hunting will be used to keep the deer population from growing to the extent that the habitat might be endangered.

Other Birds

The refuge is important to shorebirds and wading birds. Wherever possible, water will be managed to create favorable conditions for these birds so the public may view these fascinating and often overlooked birds. When necessary, special efforts will be made to protect and preserve habitat important for songbirds that use the refuge.



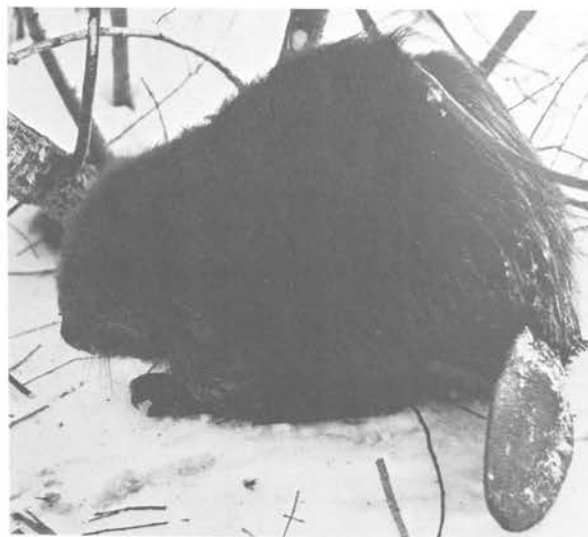
All wildlife, even predators like this great horned owl, have a place in this refuge.

Furbearers

Many of the animals native to the river lands are important as furbearers. Some, like muskrats, make a major contribution to the local economy. As many as 228,000 of these have been trapped in a single year.

Trapping of furbearers must be carefully managed for they add to wildlife values of the river. River marshes can be improved by muskrats creating openings and by beavers constructing dams and digging channels. Indiscriminate removal of these valuable animals can undo much of the good they have done.

Other furbearers found on the refuge include raccoon, opossum, skunk, fox, mink and otter. Public trapping of all species will be permitted in accordance with state laws.



Furbearing animals like the beaver provide countless hours of enjoyment for outdoorsmen who continue the traditions of the fur trapper.



PUBLIC USE

Nearly four million people live within 100 miles of the Upper Mississippi Wildlife and Fish Refuge. A half-million people live immediately adjacent to its boundary. These millions of Americans are turning to the outdoors for recreation, relaxation and rewarding use of their leisure time as never before. The river, with its varied recreational opportunities, is a natural attraction. In 1967, there were more than 1,800,000 visitors to the refuge. This may increase four-fold by the year 2000.

Accommodating this increasing demand upon refuge land and waters without affecting the wilderness characteristics and wildlife values of the refuge requires careful planning. Care must be taken to protect the land from overuse and improper uses that would detract from its basic values. With proper planning for development, staffing and financial support a balanced, rewarding use can be made of the refuge. The varied recreation program will emphasize wildlife-oriented activities, enabling the visitor to gain a better understanding and appreciation of the contributions and relationships of wildlife to man.

Information and Interpretation

To enjoy and appreciate the river environment, the visitor should understand the inter-play of all the resources in the river valley. An active program of information and interpretation will be developed on the refuge to acquaint the visitor with the wildlife, recreational, historical and social values of the great river.

The 285-mile-long refuge is divided into six districts. Each district will have a visitor center to serve the public using that district.

Uniformed personnel will assist visitors at the visitor centers and will operate boat and automobile patrols throughout the refuge to assist visitors. Leaflets and maps will be available to acquaint visitors with recreational opportunities.

Specific features of the river valley will be explained with exhibits, slide talks and films. Throughout the refuge the interpretive program will include information stations, nature trails, signs and campfire programs.

The Upper Mississippi Refuge has natural endowments that are well above the ordinary in quality and recreation appeal.

The refuge will help many Americans learn about the wilderness environment and its basic importance to all of us.



*In 1967 nearly
800,000 anglers
used refuge waters.*



Fishing

The backwater sloughs and channels of the river offer a variety of sport and commercial fishing. Some of the more important sport fishes in the river are sunfish, walleye, sauger, black bass, northern pike, white bass, crappie and catfish.

Additional access will be provided to favored fishing spots especially below the big dams and in the backwaters. Sport fish are managed by the state conservation agencies, and all fishing is in accordance with state regulations.

Commercial fishermen take millions of pounds of carp, buffalo, sheephead and catfish annually. This important river industry will continue under state regulations.

Hunting

The Mississippi River is one of the Nation's major waterfowl hunting areas. Other important game species, including deer and squirrels, can be hunted on refuge lands. A combination of good wildlife management and access site development contributes to making this one of the best hunting areas of the Midwest. Hunting is in accordance with applicable federal and state laws.

*Over 60,000 waterfowl
hunters used the refuge in
1967, including the unique
scullboaters.*



Boating

The refuge, with 285 miles of the Mississippi River and a maze of channels, sloughs, marshes, open lakes, and ponds, offers unlimited opportunity for boating and canoeing enthusiasts to enjoy an outstanding outdoor recreation area. To enhance these activities and promote better distribution, many refuge access areas will be improved and new ones built. The refuge access areas are supplemented by many private and municipal marinas. Improvements will consist of new launching ramps, parking areas, comfort stations, and information points.

Camping

Campgrounds accessible only by boat will be established on a few islands. Facilities will include tables, fireplaces, drinking water, and toilets. Primitive camping will continue to be allowed elsewhere on the refuge.

Picnicking

Although picnicking is allowed throughout the refuge, special facilities will be provided only at designated sites. These sites will include tables, fireplaces, water and sanitary facilities. Elsewhere picnicking will be primitive and users will be required to take their litter home.

Sandbars

Sandbars offer attractive, relatively secluded camping and picnicking sites. These will remain undeveloped — unique and inviting retreats in the heart of a bustling waterway.



Sandbars are the most popular sites for the mid-summer visitors.



The river vistas are often a reward to the cross-country traveler as well as the river visitor.

Observation Points

Development of overlooks and lookout towers will enable visitors to appreciate the vastness of the natural beauty and wild character of the river valley. Since there are no bluffs within the refuge, attempts will be made to establish cooperative facilities at overlooks on federal, state and local parks by furnishing interpretive signs at these sites. Points on the river giving particularly fine views of the bluffs will be located on maps for the benefit of visitors.

Trails

Footpaths originating at highway pulloffs and access sites will be developed to encourage nature walks into areas of interest. Marked routes in sloughs and channels will be laid out for self-guided boat and canoe tours. On some trails, interpretive signs will be installed to assist people in understanding and appreciating river-land ecology. Photography blinds will be built along some trails for birdwatchers and other naturalists. Elevated or floating walkways will be constructed in marshes. Throughout the refuge, facilities will be provided to promote unhurried study and understanding of wildlife and wildlife management.

Comfort Stations

Periodic flooding prohibits establishment of permanent sanitary facilities throughout much of the river bottoms. However, heavy use of the river makes these facilities necessary to prevent pollution and protect public health. It is planned to provide floating, sealed comfort stations at strategic locations throughout the refuge. Some will be moored at heavily-used beaches.

Wilderness

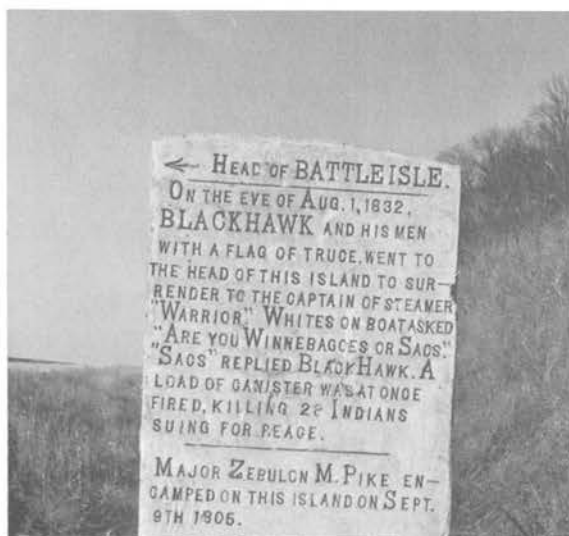
In accordance with the Wilderness Act (P.L. 88-577), refuge islands will be studied to determine their suitability as wilderness areas. If included in the National Wilderness Preservation System, the islands will provide a place of solitude for those who seek to be away from the noises, sights and crowds of mechanized civilization.



Hundreds of islands in the river preserve the river's air of wilderness.

River Lore

The lore of the river is everywhere and continues to tug at the imagination of the visitor. Stories of past adventures, the development of mid-America and the history of the area will be told as a part of the interpretive program of the refuge.



Many sites along the river can be used to illustrate or interpret the historical heritage of our Nation.

Great River Road

A continuous system of highways closely following the Mississippi River is becoming a reality. Also being considered is the Mississippi River Trail, a scenic hiking trail, which will parallel the Great River Road. The Bureau of Sport Fisheries and Wildlife will cooperate with these developments by making the recreational, scenic and historic sites on the refuge part of the river road system.



The Great River Road will provide ready access at all times for all recreational uses.

ROLE IN THE NATION

The Upper Mississippi River Wildlife and Fish Refuge is part of America's heritage because of its unusual wildlife, inspirational and recreational values.

Preserving its grandeur and providing high quality recreational use will be a major contribution to society.

Many of the benefits realized from the refuge cannot be measured in dollars. Wildlife has values that are largely aesthetic. As man becomes more aware of his environment and the need for wild areas and wildlife, the Upper Mississippi River Wildlife and Fish Refuge will grow in importance to the Nation.



Other benefits are indirect, but important:

Providing habitat and protection for the internationally valuable waterfowl resource is beneficial to people from Canada to Mexico.

The resident and migratory birds found on the refuge provide interest and relaxation for a growing host of bird-watchers.

Two unique biological types are preserved on the refuge — a remnant of the western prairie flora and fauna once extensive in the upper Mississippi Valley, and a small area of original river bottom forest.



Red-backed sandpipers and lotus blossoms are only part of the great natural beauty present along the river.

Preservation of extensive tracts of land and water under different conditions and kinds and degrees of use furnishes a place to study the relationship of man to the land. Closely integrated with commerce, business, industry, and urban communities, the refuge offers examples of the maximum and minimum influences of man on his environment.

The refuge is a 194,000-acre outdoor laboratory. Refuge personnel work with schools to furnish technical assistance and information, and the refuge is often used by school groups. The value of this contribution to education will be realized as these students become part of an increasingly conservation-conscious citizenry.

Tangible benefits include:

Measurable benefits are those which contribute to the local economy. A major contribution comes from the thousands of visitors who return more than a million dollars annually to local economies. In addition to the direct return from recreation, the recreational value of surrounding real estate is enhanced by the influx of tourists, vacationers and sportsmen.

The wildlife resource also contributes to the local communities' economies; waterfowl hunters alone spend \$650,000 yearly in pursuit of ducks and geese. The value of furbearing animals trapped and removed from the refuge averages about \$100,000 annually.



Visitors of all types return money to local communities through the purchase of food, lodging and transportation.



TO ACCOMPLISH

THESE GOALS . . .

Careful, detailed planning of every part of the refuge program will be necessary if the objectives of the area are to be met. Planning and design work will require \$400,000.

The next step will be the actual construction of all the facilities required. Complete development of the refuge will cost several million dollars.

As facilities are provided and more public use is accommodated, the staff of the refuge will have to be enlarged. A staff of at least 80 permanent and temporary employees — some of them specially trained — will be required. Annual operations will be supported by a budget of not less than \$500,000.

With these resources the objectives of this major wildlife refuge can be realized and its many benefits made available to the people.



Inadequate recreational facilities, sandbar littering and limited refuge staffing are only a few of the immediate problems which must be overcome if this river refuge is to remain one of this Nation's great natural assets.

SUMMARY

Studies made by the Outdoor Recreation Resources Review Commission reveal that the demand for all types of outdoor activities will increase many-fold in the future. The scenic quality, wildness and size of the Upper Mississippi River Wildlife and Fish Refuge make it ideally suited to contributing to the recreational needs of the Nation. The development and management of the refuge, as outlined, will provide an area unequalled in wildlife resources and recreational opportunity. Without orderly development and management, this scenic corridor in the heart of the Nation may become an outdoor slum, misused beyond repair.

Carrying out of the proposals outlined here will expand economic opportunities for private industry. Firms and individuals in the vicinity will share in the benefits. The refuge is now an asset to the local and national economy; it can make a major contribution to all of the Nation's citizens.

Understanding the environment, harvest of the resources and sightseeing are only a few of the uses which can be made of the refuge. When developed, the refuge will provide for these and other uses, yet assure the preservation of the fragile natural features of the river.





As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States -- now and in the future.

AUDUBON

national
wildlife
refuge

master
plan

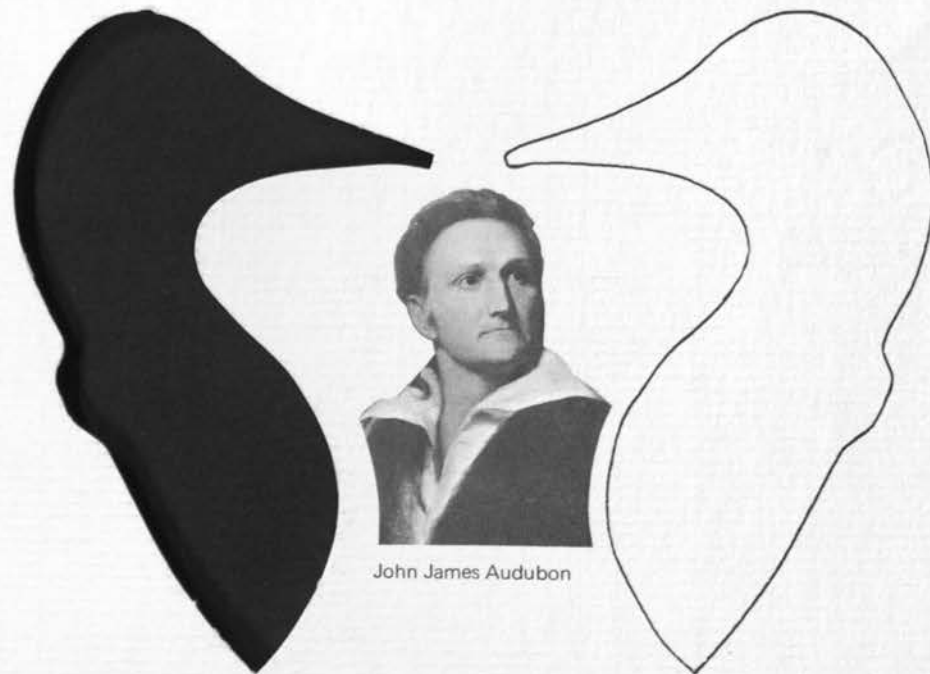
north dakota



Audubon National Wildlife Refuge is named in honor of the famous artist-naturalist John James Audubon, 1785-1851. In visiting this prairie setting during his travels, Audubon captured the moods and beauty of the plains wildlife, giving generations of Americans an appreciation of what existed here more than a century ago.

The purpose of this publication is to foster a better understanding of the long-range objectives, the management programs and the developments being proposed for Audubon National Wildlife Refuge.

Many of the species of wildlife that Audubon so dramatically recorded on canvas still exist in this area. This refuge, then, has a dual purpose: to manage these wild creatures and their habitat, and to provide wildlife-oriented recreation for Americans today and tomorrow.



The Audubon portrait and canvasback drawing are reproduced through the courtesy of the National Audubon Society and the New-York Historical Society.

John James Audubon

AUDUBON

national
wildlife
refuge





THE PAST

Man's existence here on the Great Bend of the Missouri River has been inextricably linked to wildlife for centuries. The early Indian inhabitants — Arikaras, Mandans and Hidatsas — lived and hunted here and the availability of wildlife for food often was a matter of survival. To early explorers such as Lewis and Clark, the wild game along the Missouri River was a source of food and interest.

Even before Lewis and Clark journeyed upriver en route to the Pacific, the Verendrye Brothers from the north and the "mountain men" left trails through this area, seeking trade routes and the valuable beaver "plew." By 1840, the high plains beaver trade was gone. In 1843, John James Audubon traveled the Missouri River to paint and sketch prairie wildlife species.

Two decades later, migrant farmers came, hoping to carve a living and a future from the soil. These hardy people — Germans, Swedes, Norwegians and Russians — turned the soil, spelling an end to the bison culture of the high plains tribes. The plow, the fence and the disappearance of the bison forced peace upon the Indians.

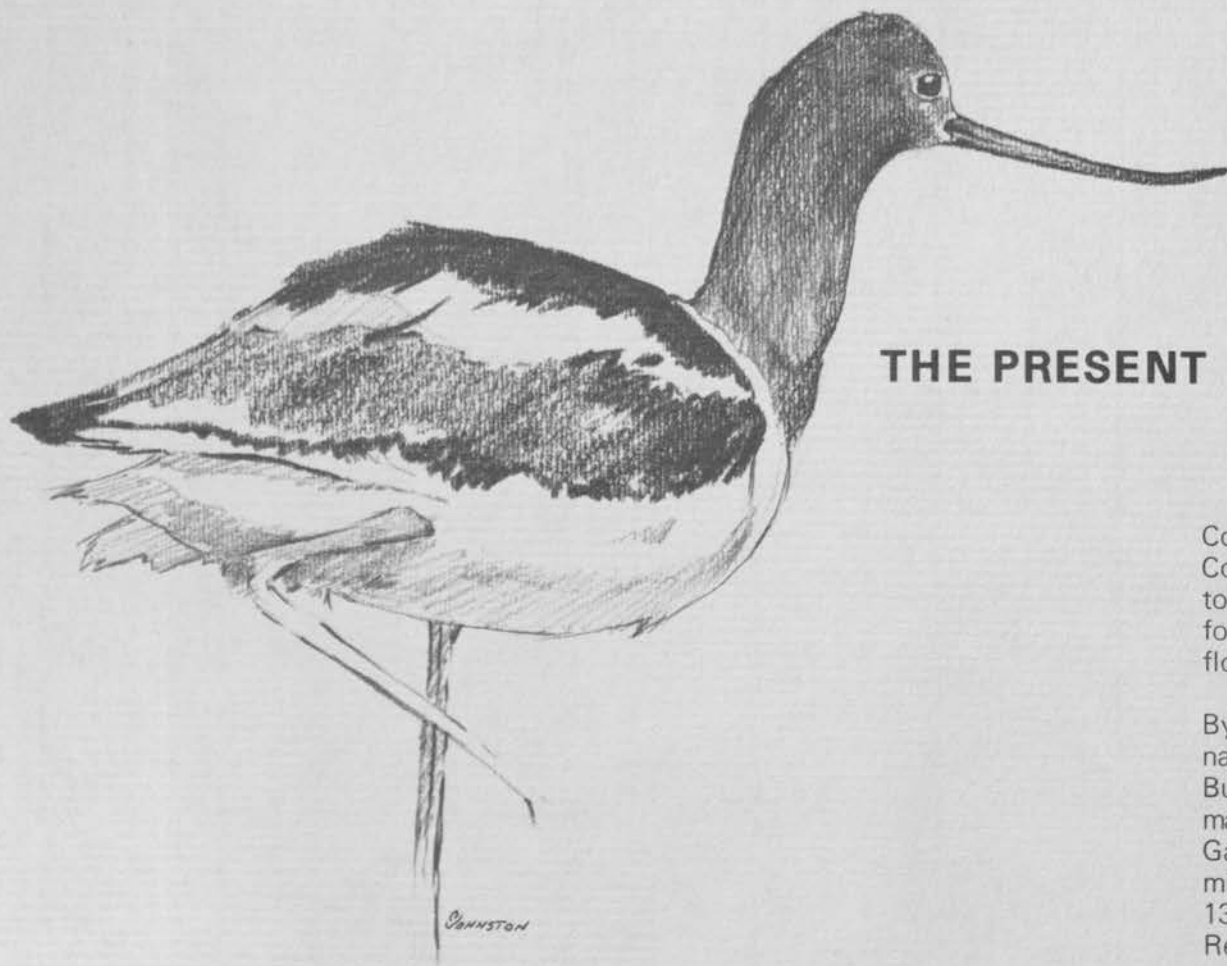
Several decades later, after the high plains had been devastated by alternating floods and drouth periods, massive public works programs began to reshape the land. Six major dams were built on the Upper Missouri to control floods, irrigate the land and generate power. One of these, Garrison Dam, created Lake Sakakawea and Audubon National Wildlife Refuge.

Vast changes in the land have occurred during the past century.

Prior to the coming of the white man, the rolling grasslands and wooded breaks supported a great variety of wildlife. Bison, elk and antelope dotted the plains; bear and wolf were common. Now bison are found in managed, fenced enclosures. The elk, bear and wolf have been forced into more secluded retreats.

Reservoirs created by the dams flooded much wildlife habitat. Potholes have been drained, fences limit the range and the remaining wildlife is crowded into undisturbed areas. Modern man finds in this remaining wildlife a recreational outlet, a challenge to his outdoor skills and a link with nature and the past.





THE PRESENT

Construction of Garrison Dam by the Army Corps of Engineers was authorized by Congress to control Missouri River floods, provide storage for irrigation, support downstream navigation flows and generate power.

By authority of the Fish and Wildlife Coordination Act, the Corps of Engineers permits the Bureau of Sport Fisheries and Wildlife to manage the 25,000-acre Snake Creek Arm of Garrison Reservoir in carrying out the national migratory bird management program. The 13,498-acre Snake Creek National Wildlife Refuge was established May 25, 1956.

In 1967, the refuge was renamed Audubon National Wildlife Refuge to honor the famous artist-naturalist John James Audubon. Garrison Reservoir was also renamed Lake Sakakawea and the Snake Creek Arm was renamed Lake Audubon. The remaining portion of the Lake Audubon area is administered by the North Dakota Game and Fish Department as the Snake Creek Game Management Area.

In this multiple use reservoir project, the refuge is only a part but it fills a critical need. It preserves a segment of the natural environment, a quality aspect of outdoor recreation now sought by people.

The refuge has had a profound effect on wildlife in the area. Many wildlife species which have been displaced or eliminated elsewhere remain abundant on the refuge. White-tailed deer, antelope, Canada geese, mallards, upland plover and avocets are some of the species commonly observed.

Native prairie grasses, after years of overgrazing, are returning. Visitors to the refuge see prairie wildlife and vegetation as they existed before the white man came.



THE REFUGE PURPOSE

Audubon Refuge is an important unit of the National Wildlife Refuge System. This system is designed to preserve and manage wildlife in its natural environment for the enjoyment and enrichment of the American people.

As part of this important national effort and as a memorial to John James Audubon, the refuge will meet these objectives:

To produce a maximum number of wild ducks.

To maintain conditions suitable for Canada goose production.

To manage lands and water to benefit migrating waterfowl.

To provide a wildlife-oriented recreation program to complement the more broadly-based recreation program of Lake Sakakawea.

To provide public hunting and fishing opportunities consistent with other objectives.

To provide habitat and protection for rare and endangered species of wildlife.

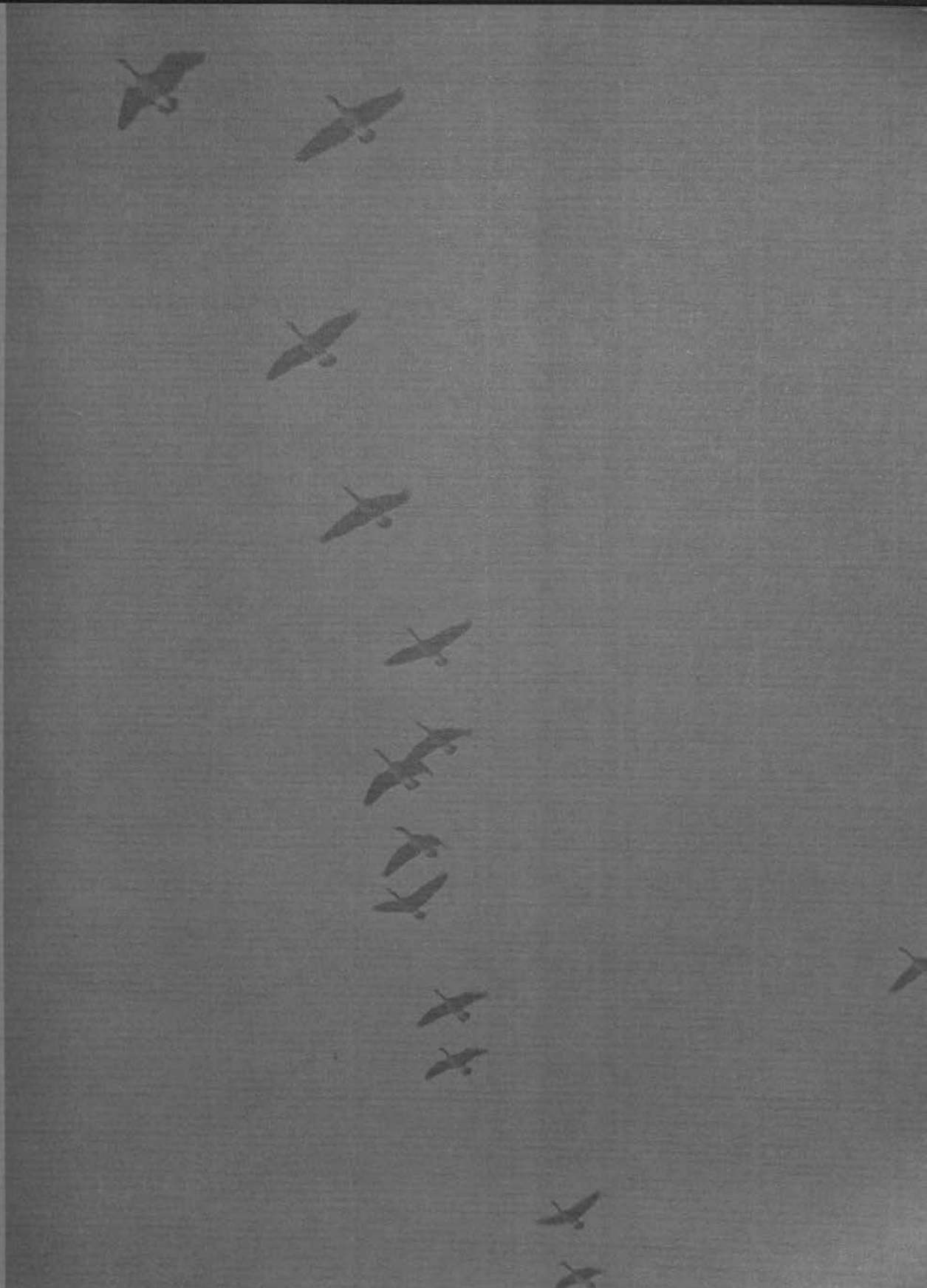
To develop and manage habitat for populations of big game and fur-bearing animals, upland birds, marsh and water birds.

To interpret by means of displays and other facilities the meaning and value of these resources and to make possible a more complete understanding of this environment. This will make the Audubon Refuge a true memorial to the scientific curiosity and deep respect with which John James Audubon viewed the wilderness prairie.



THE PLAN FOR THE FUTURE

Audubon National Wildlife Refuge has two responsibilities: to fill its role in the program of the National Wildlife Refuge System, and to contribute to the local recreational program. Thus, it must provide for wildlife as well as accommodate the visitors who come here to enjoy wildlife. On the following pages are proposals for fulfilling these needs.



WILDLIFE



Audubon National Wildlife Refuge is blessed with productive wildlife lands, fertile soil, an abundance of water and a warm summer season. These, working together, create conditions which support rich plant and animal life. Management and development of the refuge will take full advantage of this harmony to produce more wildlife for public enjoyment.

RARE AND ENDANGERED SPECIES

Three rare and endangered species stop at Audubon Refuge during their migration or visit the refuge periodically. These are the peregrine falcon, the whooping crane and the western burrowing owl. Limited uplands on the refuge prevent any special management for these species but the refuge does extend protection and freedom from disturbance to these occasional visitors.

GEESE

Wild geese have been using the Audubon Refuge area for many years; on their journey up the Missouri Lewis and Clark observed "brant" near the mouth of Snake Creek. However, intensive farming and hunting pressure have prevented them from using the area in recent years.

Sanctuary and food provided by the refuge will attract these big birds, giving people an opportunity to observe and hunt the Canada, white-fronted, snow and blue geese.

Islands in Lake Audubon are ideal for Canada goose nesting. A breeding flock of Canadas has been introduced and now is spreading into habitat outside the refuge. These birds are highly prized by hunters and provide spectacular viewing for visitors. An objective of the refuge will be to produce at least 500 Canada geese annually.

SWANS

Stately whistling swans move through North Dakota on their spring and fall migrations, adding a touch of grace and beauty to a wildlife area. Stabilized water levels and emergence of aquatic vegetation in Lake Audubon will attract these swans. Providing for the needs of these birds is a refuge objective.

DUCKS

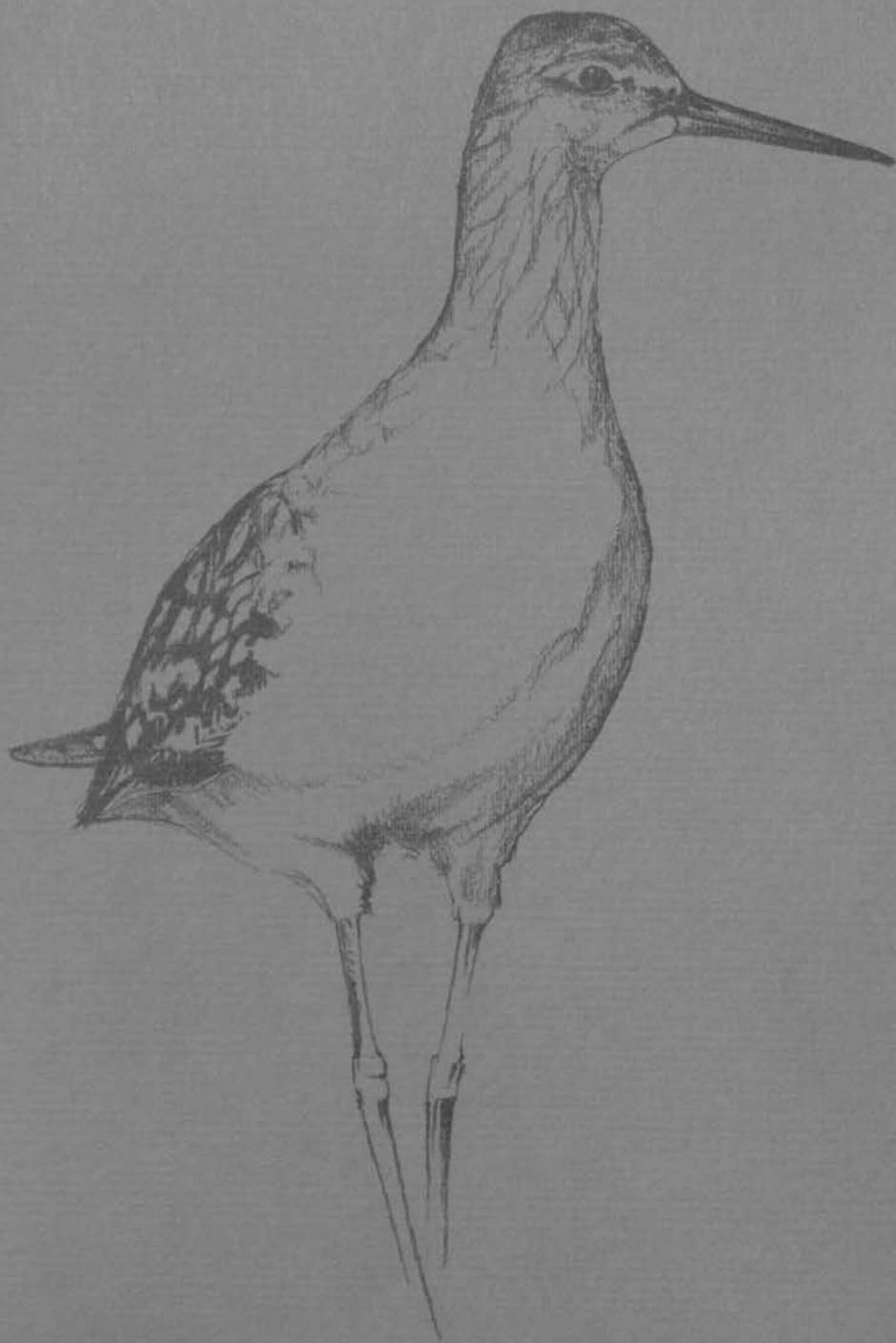
One major objective of the refuge is duck production, for which this refuge is well suited. Habitat here is best suited to producing mallards, gadwalls, pintails and blue-winged teal. These species are popular with duck hunters in the Central Flyway. They are popular, too, with the growing army of amateur ornithologists, a major group of non-consumptive users who find enjoyment in observing these birds in their natural surroundings.

One objective of the refuge is to increase production of these species to 4,000 ducklings annually.

Redhead and canvasback ducks are less abundant. Periods of drouth on their breeding grounds have severely reduced their numbers. Ultimate stabilization of Lake Audubon's water level will encourage the growth of cattail and bulrush stands in sheltered bays, improving both canvasback and redhead production.

During the summer months when wild ducks molt and they cannot fly, thousands move into the refuge where they find a safe haven. Migrating waterfowl require food, water and protection. An objective will be to provide these for as many as 80,000 waterfowl each fall.





BIRD LIFE IN GENERAL

One of the spectacular sights on Lake Audubon is the activity of large flocks of white pelicans and double-crested cormorants. Visitors also enjoy seeing the common tern nesting colonies on the islands; other bird enthusiasts watch sharp-tailed grouse on their dancing grounds. Shorebirds and small songbirds are abundant in the marshes and uplands, and management of these habitats for waterfowl will benefit these smaller cousins. An abundance and variety of bird life will increase visitor enjoyment at the refuge.

FURBEARERS

Most furbearers common to the Dakotas are found on the refuge, with red foxes, skunks and raccoons the most numerous. Carefully planned control of these animals may be necessary on selected refuge areas to protect waterfowl during the nesting season.

Mink and muskrats are less common but will increase as marsh vegetation develops. When these animals multiply, trapping by the public will be allowed to control populations and offer additional outdoor recreation.

BIG GAME

White-tailed deer thrive on the open North Dakota prairies. Refuge deer management is aimed at providing grain for winter feed and tall, weedy growth for winter shelter. Although the refuge has been open to deer hunting for several years, rising water levels will ultimately reduce deer habitat sharply and hunting may then be restricted. Until that time, hunting will be allowed under state regulations.

Pronghorn antelope were re-introduced into the Coleharbor area in the early 1950's where they readily adapted to the grain farming-cattle raising economy. The pronghorns are mobile and range widely and the refuge population has varied from 30 to 100 animals in recent years. A popular form of wildlife with visitors, the pronghorns will be maintained on the refuge. Surplus animals will be harvested by the public under state hunting regulations.

FISH

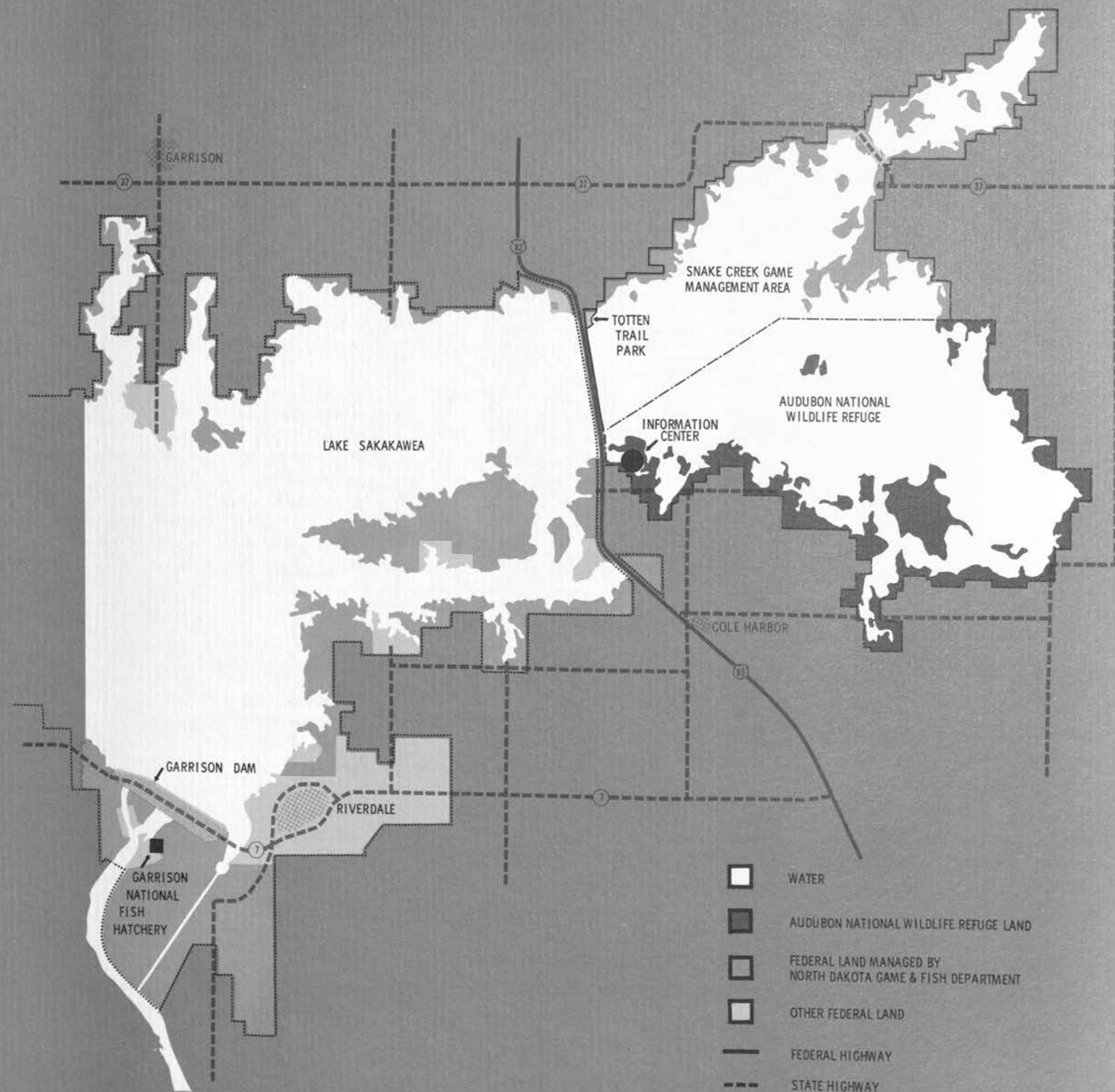
As in most new impoundments, fish life has become abundant during the period of filling. Northern pike, yellow perch, carp, black crappie, goldeneye, largemouth bass, fathead minnow and walleye are species that may be fished in the lake under state fishing regulations. No fish management is proposed for the refuge waters except for carp control in the proposed sub-impoundments. Carp are detrimental to waterfowl food plants.



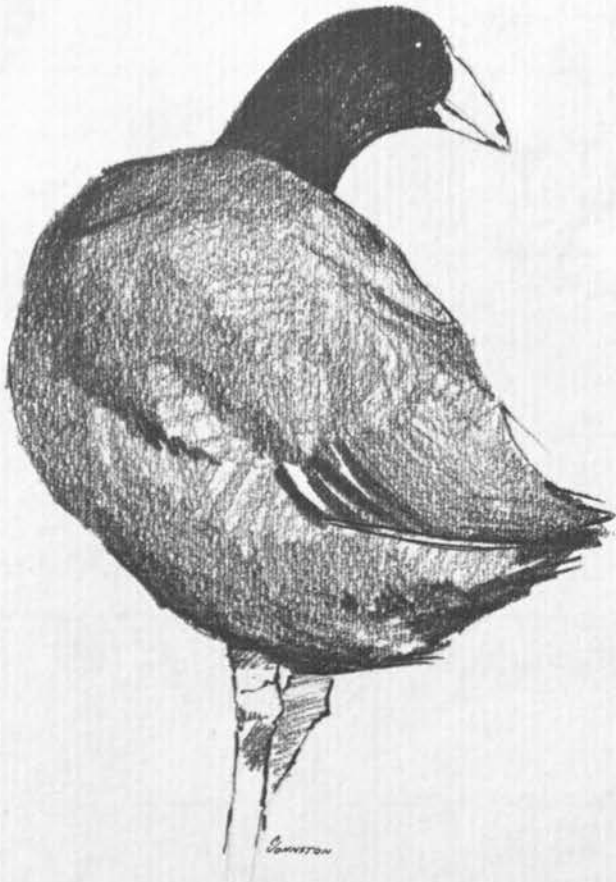
AUDUBON

national
wildlife
refuge





LAND AND WATER



Audubon Refuge was once a rolling prairie complex dotted with hills, shallow freshwater marshes, alkaline sloughs and small intermittent stream drainages. Farmers planted crops on the better land and grazed the hills.

Significant changes are occurring which will affect land and water management on the refuge. Once Lake Audubon is filled, much of the refuge will be a large open-water lake, studded with islands, with only a narrow fringe of uplands bordering the water. New challenges must be met to manage these lands and water for wildlife while meeting the overall needs of the Garrison Diversion and Irrigation Project.

CROPLANDS

Much of Audubon Refuge was farmed to grow wheat, barley, oats, flax and rye in previous years as part of an overall land and water conservation program. Such farming is beneficial to wildlife.

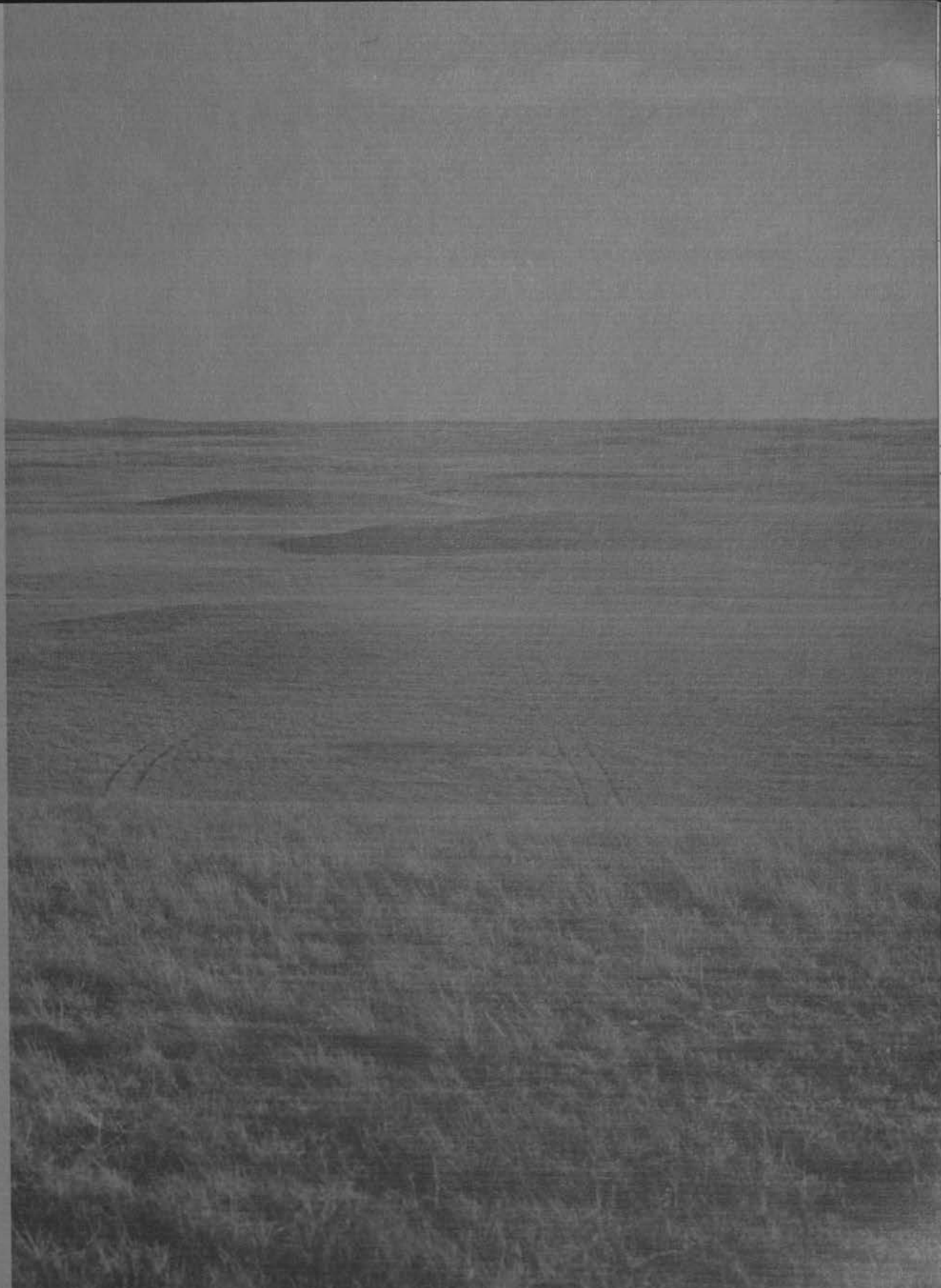
Little farmland will remain, once Lake Audubon reaches its maximum level. However, some upland tracts will be maintained as wildlife food plots by the refuge. This cropland will be supplemented by more extensive food plantings managed by the North Dakota Game and Fish Department on adjacent lands.

GRASSLANDS

Refuge grasslands mirror man's influence on the prairies. Native wild grasses existing here for centuries still remain but frequently the original prairie is dotted with patches of tame grasses introduced by homesteaders and farmers. Abandoned cropland areas are characterized by a third type of vegetative cover. These are "go-back" areas which usually include a mixture of weeds, annual grasses and small plots of volunteering native and tame grasses.

Local farmers are permitted to graze a limited number of cattle and, in years of drouth, emergency haying is allowed. Grasses contribute to wildlife by providing nesting and escape cover for waterfowl, upland game, big game and other wildlife. Some food is provided, too, for upland game. Native prairie grasslands will be retained for their esthetic, historical and scientific value.

Unfortunately, most of the grasslands will be inundated by the rising water levels of the reservoir. Remaining grasslands will be managed exclusively for wildlife. Mowing and other accepted management practices may be carried on periodically to remove excess growth and improve the vigor of the stand.





WETLANDS

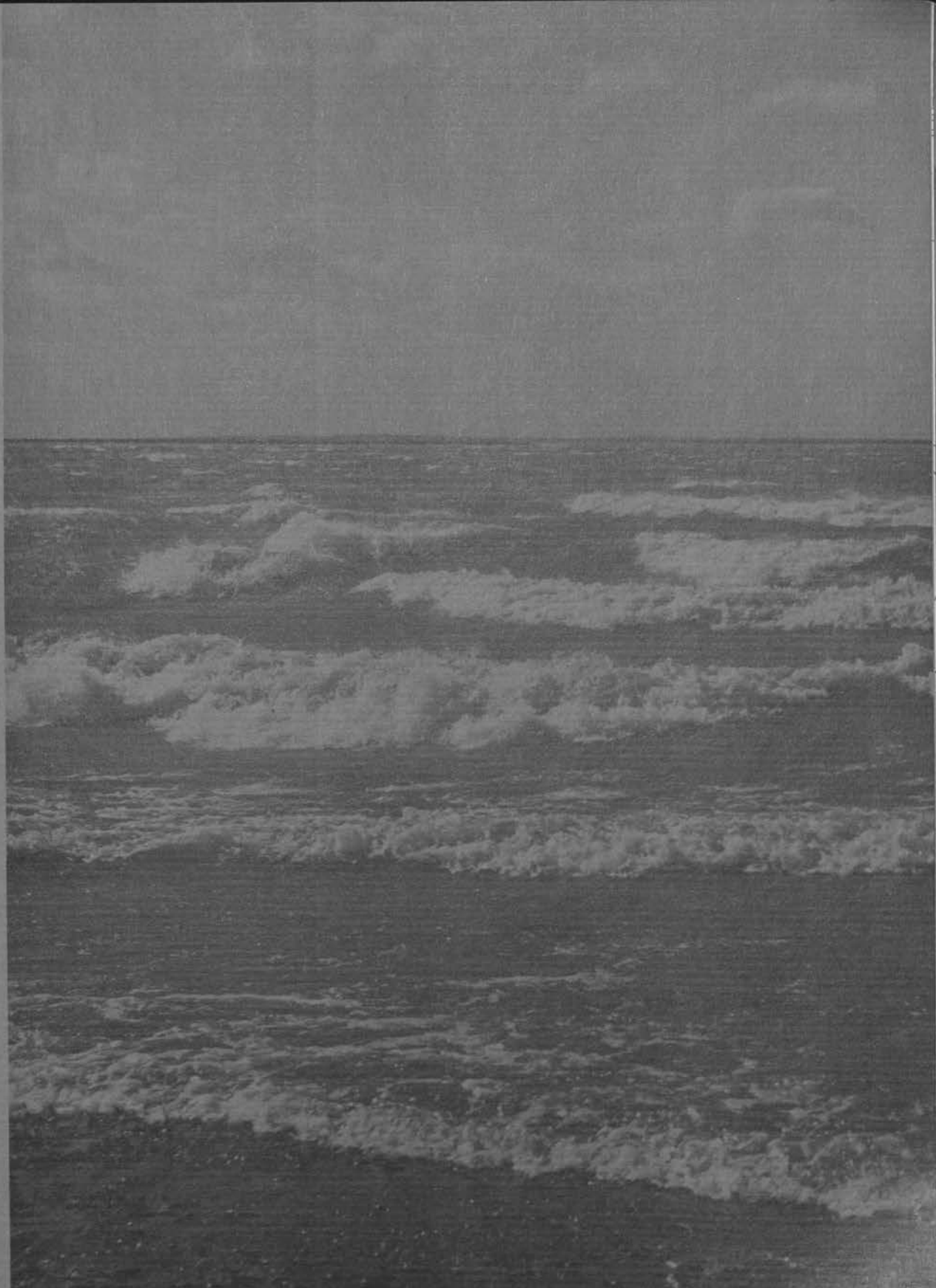
To offset a deterioration in waterfowl values as water levels rise in the reservoir, certain positive management practices can be carried out.

Deeper waters in Lake Audubon will be of less value to waterfowl. Only by assuring availability of shallow marsh areas containing food plants and vegetation suitable for nesting and brood cover can the needs of waterfowl be met.

This can be accomplished by diking off selected bays in Lake Audubon to create sub-impoundments. These will be managed so that flooding, drying and reflooding will nearly duplicate the natural cycles of flood and drouth which make natural wetlands so productive of waterfowl.

Sub-impoundments will provide some shallow marsh but the majority of waterfowl habitat will be created naturally on the main pool. As water levels stabilize, emergent aquatic vegetation will become established in the shallow areas, creating more favorable waterfowl habitat.

Although wave erosion will be severe on shorelines and islands, the large number of islands and the miles of irregular shoreline are important features and should be preserved for waterfowl use and their scenic beauty. Artificial nesting islands or platforms will be constructed in suitable areas to supplement the natural islands used by waterfowl.



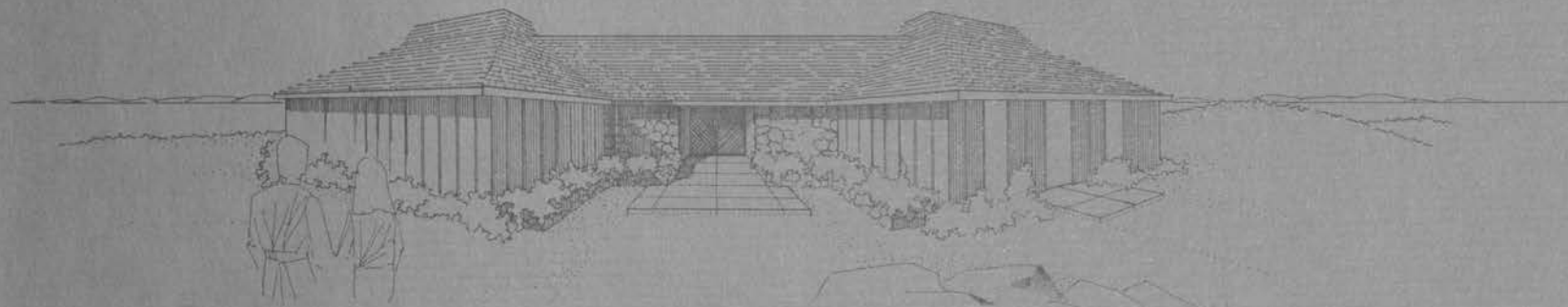
PUBLIC USE



Although recreation is only one of the benefits of the Garrison impoundment and is a by-product of this multi-purpose project, it is an important contribution to the surrounding community. The 324,000-acre Lake Sakakawea offers swimming, boating and excellent fishing opportunities. Along the reservoir's 1,340 miles of shoreline are camping sites, boat ramps, beaches and one fish hatchery.

More than 100,000 people live within a 100-mile radius and thousands are drawn to the lake for fishing, hunting and water sports. U.S. Highway 83, a main artery between Minot and Bismarck, is a transcontinental north-south route.

The role of Lake Audubon in this broad-based recreational program is to offer opportunities for nature-oriented activities. The Snake Creek Game Management Area, managed by the North Dakota Game and Fish Department, is intended primarily for hunting and fishing. The Totten Trail Park at the northwest corner of the pool has facilities for camping and picnicking. Audubon Refuge has much to offer in wildlife observation and in creating an understanding of man's relationship with nature. Through development, visitors can enjoy the wildlife typical of an earlier era on the wind-swept prairies.

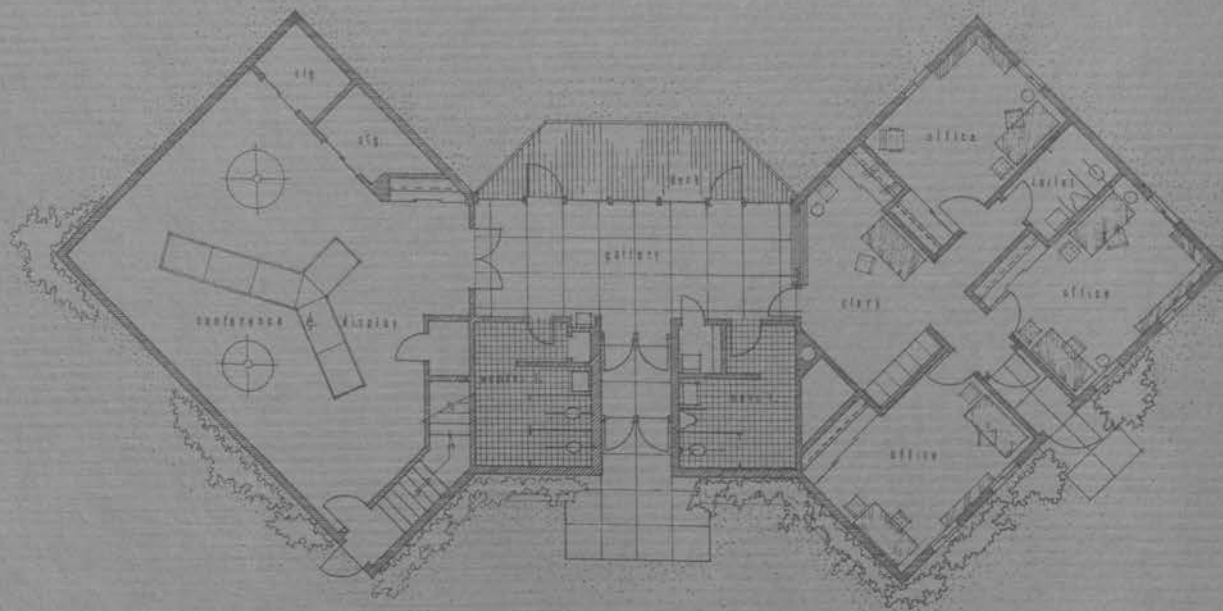


INFORMATION

An information center will be located in the administrative office of the refuge. Here the visitor can obtain information on Garrison Reservoir, the extent and purpose of the refuge, federal waterfowl production areas and the wildlife management units of the Garrison Diversion Irrigation Project. The information center will serve all visitors to Garrison Reservoir.

Uninformed personnel will assist the visitor in learning about available recreation facilities. Literature and maps also will be available for this purpose.

The story of the Missouri River, of John James Audubon, of Lewis and Clark and of the refuge will be told with a variety of audio-visual tools.





WILDLIFE INTERPRETATION, SIGHTSEEING AND PHOTOGRAPHY

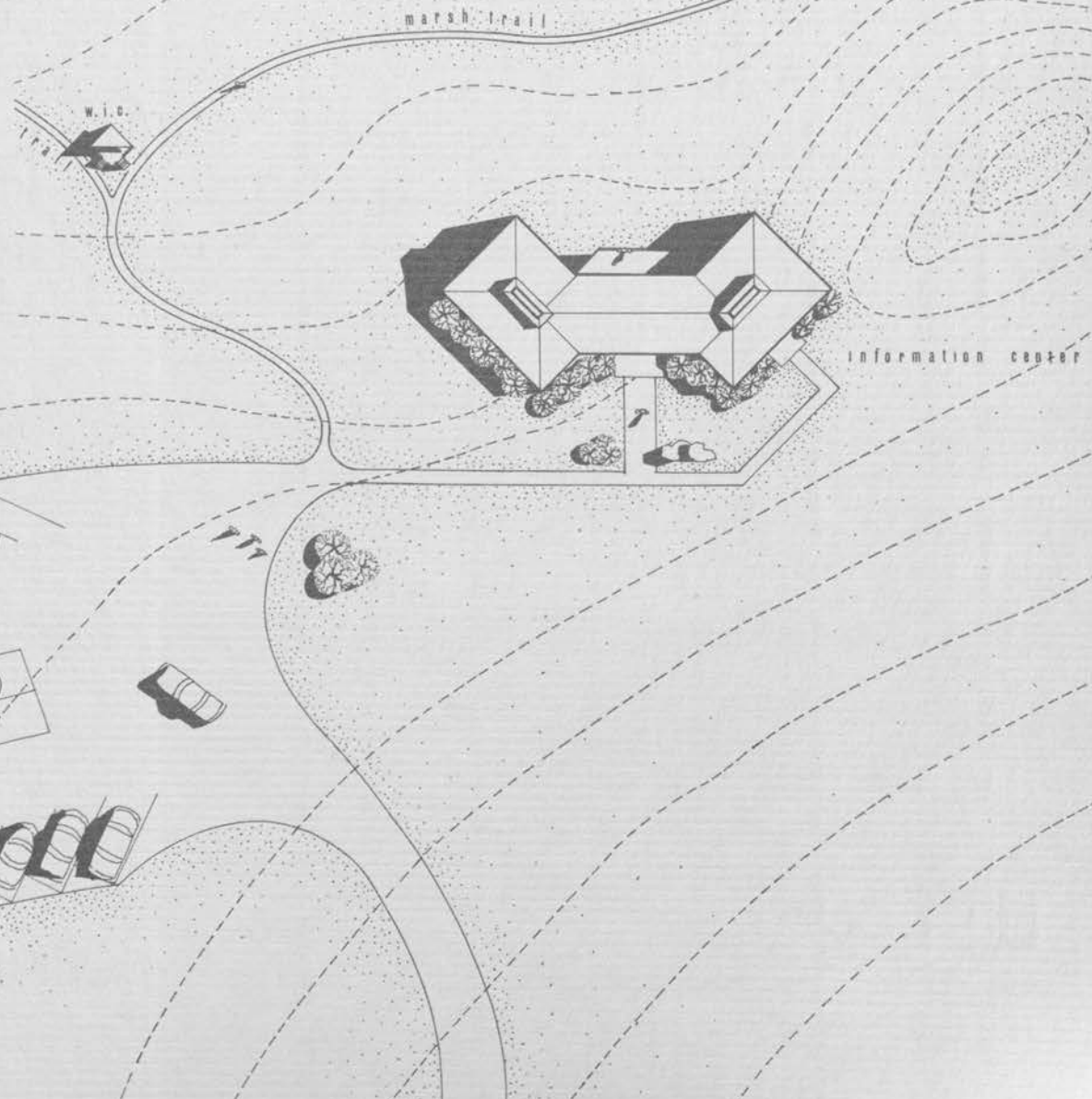
Refuge visitors will have the opportunity to see impressive waterfowl concentrations, a variety of other birds, white-tailed deer, pronghorn antelope and other resident game. These will be seen in a setting nearly identical to that seen by Audubon when he visited this area more than a century ago.

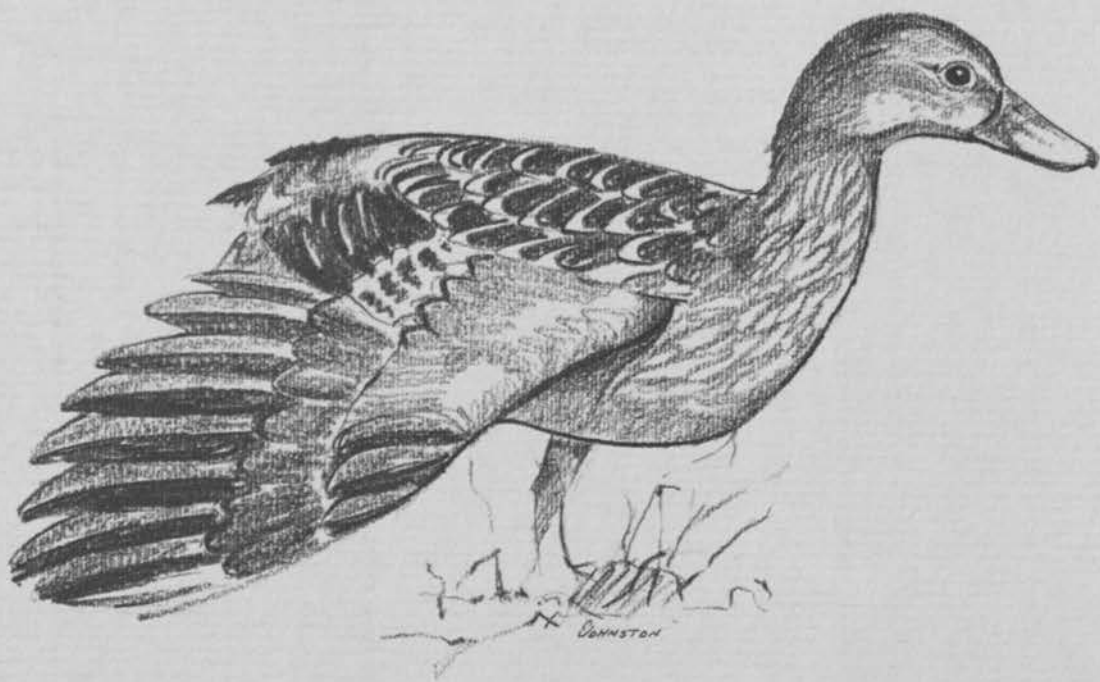
To assist the visitor in appreciating and understanding wildlife and wildlife management, a hiking trail with interpretive signs will be developed. Beginning at the information center, the trail will meander through a variety of prairie grass and marsh habitats. Signs will explain these ecosystems so that even the casual visitor will learn of the relationships of land, plants, wildlife and weather. An automobile tour also will be available. Visitors will be able to see the refuge and its wildlife on supervised evening tours.

Students of history will find Indian "tipi rings", an early settlers' cabin and the wildlife species that helped sustain the Indians and pioneers. The refuge's interpretive program will highlight these historical points of interest with emphasis on the journeys of Lewis and Clark and Audubon through this area.

Other interpretive media will be used in the information center to tell the story of Audubon Refuge. Facilities for lectures, motion picture and slide presentations will be available at the visitor center. Conservation workshops and meetings will be conducted here. The center will serve as the starting point for the interpretive trails and as the focal point for the overall refuge wildlife interpretive program.

Observation towers and photography blinds will assist the visitor in enjoying representative sections of marsh, lake and grasslands and to observe and study plants and animals in their natural surroundings.





FISHING

Sport fishing opportunities are numerous locally. Both Lake Sakakawea and Lake Audubon provide excellent angling. To avoid disturbance to waterfowl during their nesting season, it may be necessary to restrict fishing on the refuge portion during that critical period. Fishing will be in accordance with state regulations.

HUNTING

Although the refuge is managed primarily for waterfowl, other wildlife species benefit from this management. Deer and antelope have increased in number with the development of the refuge. Public hunting allows use of these species, as well as the upland game found there. This hunting will be permitted as long as harvestable populations remain. Both big and upland game species move on and off the refuge constantly, providing hunting on lands adjacent to the refuge.

Even though planned inundation of part of the refuge will eliminate much of the upland game habitat, every effort will be made to help the visitor see wildlife species in their natural habitat.

Audubon Refuge, operated in conjunction with nearby North Dakota Game and Fish Department game management areas, provides excellent waterfowl hunting. Feeding and rest areas on the refuge help attract waterfowl and hold them during a prolonged hunting period, while adjacent state areas provide public hunting opportunity. Canada goose hunting has been restricted in the vicinity to protect the refuge flock and to help attract and hold migrant geese. This restriction will be removed when the local flock has reached a desired level.





ROLE IN THE COMMUNITY

When the refuge was first established, most of the land was planted to crops. As a result, the major economic contribution of the refuge has been the grazing and farming programs in which local residents participate. With the water area of Lake Audubon gradually increasing, cropland has been flooded and lost to crop production. However, waterfowl production and other wildlife values have increased as a result.

Preservation of wildlife and its habitat produces values that cannot be measured in dollars and cents. The esthetic and spiritual worth of wild lands is growing and, one day, may become Audubon Refuge's most significant contribution to the community and the state.

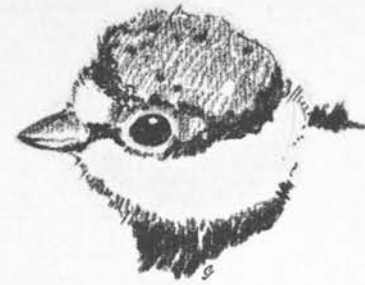
Another important value will be the benefit received from the refuge's education and wildlife observation programs.

Local schools need outdoor and conservation-oriented programs for students. The refuge,

already involved in such programs for school children, will expand these efforts with organized tours, lecture programs and similar activities.

The refuge has been functioning as an information center for local recreation because of the office's advantageous location. It will expand this service, coordinating its efforts with other agencies and with local businesses.

The public recognizes the competition wildlife faces as a result of modern technology. This technology has made valuable contributions to our social, cultural and economic life but also has created problems such as air and water pollution and chemical poisoning of the environment. Some space must be set aside for wildlife. Consciously or not, both area residents and visitors have a feeling for the esthetic values that result from undisturbed wildlife living in the spaciousness of the prairies.



OPERATIONS

Many new improvements are needed to meet public demand for services and facilities at Audubon National Wildlife Refuge. Along with the office-information building, a new equipment building, residences and improved roads are needed. Maintenance equipment is military surplus and needs replacement. These improvements, plus a permanent work staff of five, are necessary for efficient refuge operations and to adequately provide needed public services.

COST

Cost of the development outlined in this plan totals \$745,000. Water facility improvement will cost \$122,000, with biological developments costing \$33,000, buildings costing \$261,000, roads and trails costing \$210,000, structures and utilities costing \$83,000, fencing and posting costing \$25,000 and public use facilities costing \$11,000.



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UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE

we can help



A TEACHER'S GUIDE TO ENVIRONMENTAL EDUCATION ACTIVITIES



U.S. FISH AND WILDLIFE SERVICE, GREAT LAKES REGION, U.S. DEPARTMENT OF THE INTERIOR



We Can Help and the **Outdoor Classroom Guides** are part of a series of materials to help further community based environmental education. They were produced under contract to the Fish and Wildlife Service, North Central Region, U.S. Department of the Interior. Work was done under the supervision of Peggy Charles, Environmental Education Specialist, U.S. Fish and Wildlife Service.

Written by Donald J. Wagner and Edward Hessler

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1 START HERE

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4 WE CAN HELP

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OUR PURPOSE

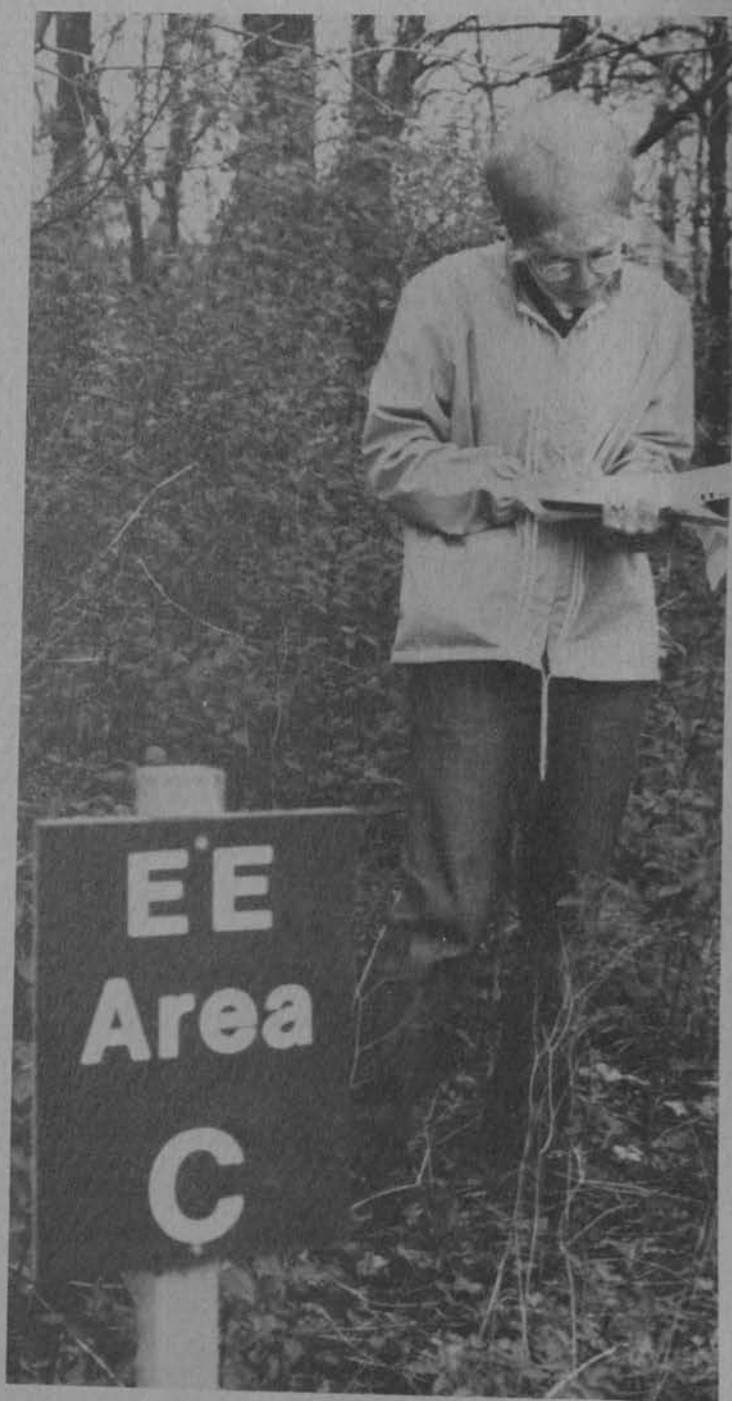
We would like to share our land and wildlife with you. The U.S. Fish and Wildlife Service can introduce you to study locations and teaching services which will stimulate your students. They can help make your teaching easier.

There are several ways to learn from a natural resource: through recreation, photography, poetic expression, fishing, or eating wild foods. But to bring the use of natural resources closer to classroom teaching, we have devoted these outdoor investigation suggestions to the PROCESS OF INFORMATION GATHERING.

You already have the teaching skills necessary to organize student activities. Students will do their own investigations, use skills and concepts which are common to many school subject areas.

Your work of teaching will be easier. Simple preparation and skill practice for students before the investigation will relieve you of constant "on-the-spot" leadership. Greater stimulation and involvement will motivate your students to increased attention and learning. Enthusiasm spills over to other work in your classroom.

• OUR RESOURCES



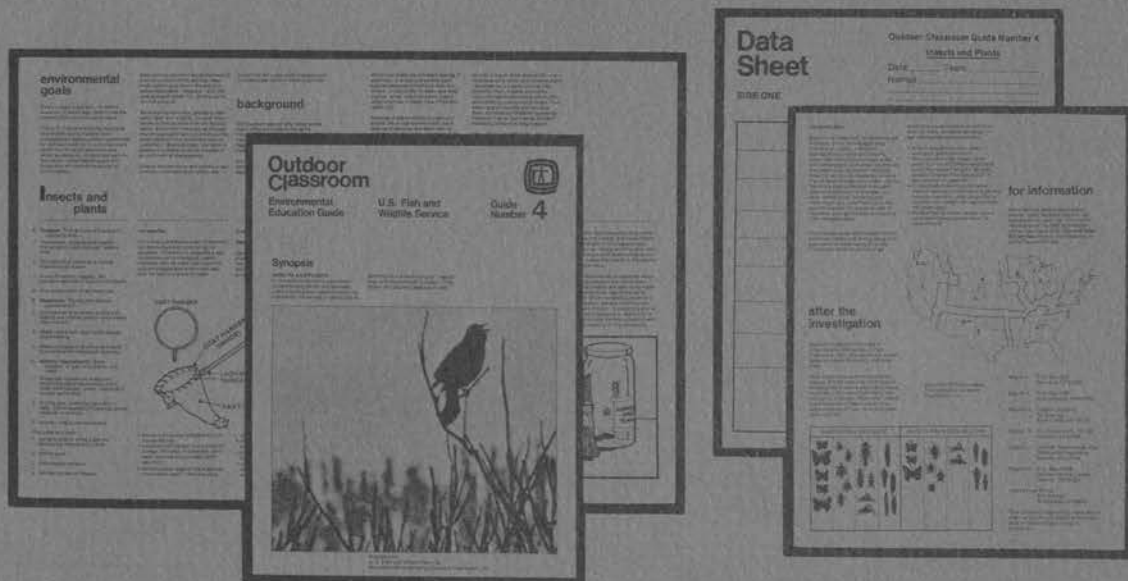
The Service can help match outdoor classroom sites to you and your students' needs. Although many of the activity guides have been developed for use on Service lands, they can be used in many kinds of outdoor locations if you are unable to make use of a wildlife refuge or fish hatchery. With these activity materials and the related study location, you are prepared to give your students an enjoyable and rewarding environmental experience.

Service people are relaxed and informed, although serious about the importance of the environment. Explain your teaching resource needs and discuss what can be provided for your students. You will find that the working relationship is as enjoyable as the natural resources from which your students will learn.

2

SECTION

ACTIVITIES



OUTDOOR CLASSROOM GUIDES

•WHAT ARE THEY?

Each guide is a complete description of an investigation involving an environmental topic or issue. Two levels have been developed: Level I is recommended for grades 4-6 and Level II for grades 7-12. The conceptual information and process skills in the guides are common to teaching programs in other areas. Most guides can be completed in one day or less.

•WHAT'S THEIR PURPOSE?

The guides provide direct outdoor learning experiences. Information collected by small groups or teams is shared and becomes the basis for large group discussion and interpretation. This process can help develop learning skills and increase understanding. These experiences can lead to a positive attitude toward the environment.

• HOW ARE THEY USED?

The guides are developed so that data collection is carried out by small groups or teams. The data are then pooled and interpreted by the entire group or class. This process can involve everyone in all phases of the investigation, providing for multiple data input and al-

lowing for large group discussion and decision making. However, it is also possible to use the guides for small group or independent projects. Each guide is written for an outdoor site, some are best accomplished at a wildlife refuge or fish hatchery, but most can take place on nearby sites such as a schoolyard, vacant lot or park.

• OUTDOOR CLASSROOM GUIDE TITLES

LEVEL 1

1. Plants and Places
2. Water Flow and Impoundment
3. A Population of Pocket Gophers
4. Insects and Plants
5. Snow Temperatures
6. Snow Depth and Snow Melt
7. Social History Cemetery Study
8. Old Ponds and Young Ponds
12. Wildlife/Wildlands Photography
13. Careers
17. Muskrats
21. Fish Hatcheries

Level I — recommended for grades 4-6

LEVEL 2

9. Deer Food Survey
10. Water Quality Analysis
11. Public Use of Public Land
14. Foreign Language
15. Waterfowl Nest Structures
16. Fire Ecology
18. Wetlands and Wildlife
19. Fish Populations
20. Public Survey
22. Farming and Wildlife
23. Redwinged Blackbird
24. Endangered Species: Mystery Birds

Level II — recommended for grades 7-12

SYNOPSIS:

A brief description of the activity.

Outdoor Classroom

Environmental
Education Guide

U.S. Fish and
Wildlife Service



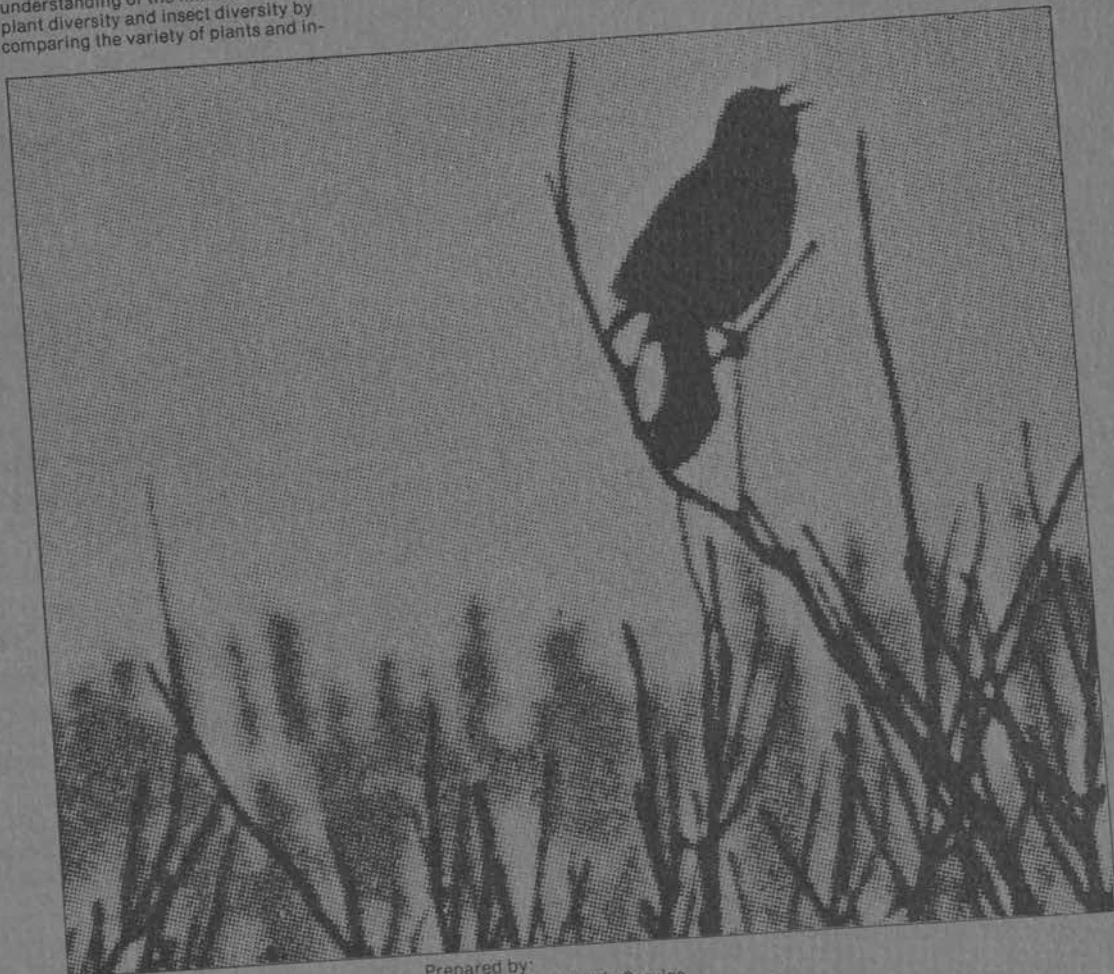
Guide
Number **4**

Synopsis

INSECTS AND PLANTS

In this activity students gain some understanding of the link between plant diversity and insect diversity by comparing the variety of plants and in-

sects found in a semi-natural "weedy" area with those found in a lawn. They collect and display samples of each.



Prepared by:
U. S. Fish and Wildlife Service
Minnesota Environmental Sciences Foundation, Inc.

BACKGROUND:

A discussion of supporting information related to the general content of the activity.

environmental goals

Every citizen's decision, or lack of decision, in some way determines the use and the future of public lands.

The U.S. Fish and Wildlife Service is the Nation's only Federal land management agency solely responsible for fish and wildlife. It is the Service's belief that through education and direct experience, citizens can gain information, understanding and attitudes that will support wise use of public lands.

Maintaining environmental harmony is a crisis concern of the Service. Man must continue to live in the world in some reasonable "balance" with the land and with other life, otherwise he will not survive.

Service programs help people to learn about land and wildlife, involve themselves in interactions with the natural world, and enrich themselves through that strange aesthetic joy which can be experienced in the midst of a wild environment. Besides these, the Service attempts to make its lands a model of environmental management.

Quality and harmony will remain a part of the environment and remain the

guidelines for public land management if citizens see value in these practices.

background

Did you ever wonder why there are so many different kinds of the same thing? There are numerous kinds of flies, beetles, worms, algae, bacteria, trees, snakes, frogs, fishes, birds and mammals.

It may seem that animals of the same kind, such as sparrows, all behave about the same way. This is not true.

When one observes different species of sparrows, it is discovered that each species behaves differently than the others. It may differ in when and what it sings; what, when and how it eats; when and how it nests; how it flies and walks; etc.

Because of the diversity of plant and animal life in the environment, each species of sparrow has been able to "put together" a unique composite of behaviors or niche. Since the niche of each species of sparrow is unique, sparrows of different species are not competing directly with each other. This allows several different kinds of sparrows to live in the same place.

And so it is with most animal life -- a diverse environment with diverse plant life allows for a diverse animal life. Diversity then, creates a complex fabric of interrelationships among the environment, plants and animals. This fabric is both flexible and durable. Even in the face of disaster caused by floods or fires or hurricanes, some of the fabric remains to begin again.

Many things can affect the natural diversity of the environment. Modern agriculture has turned the diverse native prairie into a domestic prairie of corn and wheat. What effects has this had on prairie animal life? This activity may help answer this question.

ACTIVITY DESCRIPTION:

The investigation is described in enough detail so that the user can follow the procedure step-by-step. If pre-activity planning is necessary, that process is also described here. Brief introductory activities may also be included.

PURPOSE:

This section identifies general areas of information and skills contained in the investigation.

OBJECTIVES:

Activity goals achievable by the student who participates in the investigation.

MATERIALS REQUIREMENTS:

A list of equipment and supplies necessary to complete the investigation.

A. Purpose: This activity will acquaint students with—

1. The variety of plants and insects that exist in semi-natural "weedy" areas.
2. The variety of plants and insects that exist on a lawn.
3. A way to collect, display, and compare samples of plants and insects.
4. The construction of an insect net.

B. Objectives: During this activity students will—

1. Compare an area where plants and insects are diverse with an area where they are not.
2. Make inferences about what causes this diversity.
3. Make a display of plants and insects to illustrate the concept of diversity.

C. Activity requirements: Each student, or pair of students, will need—

1. Materials to make an insect net: broom handle or equivalent, panty hose, coat hanger, pliers, needle and thread, extra wire.
2. Killing jars: baby food jars with caps, cotton soaked in fingernail polish remover or alcohol.
3. Grocery bag to contain plants.

The class will need—

1. Large pieces of white paper for displaying insects and plants.
2. White glue.
3. Felt-tipped markers.
4. Golden Series on Insects.

Introduction

On a local scale the concept of diversity can be studied and understood by students. This activity suggests a way to compare an unmanaged, weedy roadside with its plant and insect life and a managed and manicured lawn with its lack of plant and insect

diversity.

Before You Begin

Each student can make a net, or if students will be working in teams of two they might make one net for each pair. (See illustration.) Follow this procedure:

COAT HANGER



COAT HANGER (INSIDE)

LASH WITH WIRE THREAD OR STRING

PANTYHOSE

- Remove the elastic waistband from the panty hose.
- Bend the coat hanger into a circle of at least 10 inches in diameter, and twist the ends around each other securely.
- Fold the upper edge of the hose over the circle at least 1 inch and whip

- stitch with needle and thread;
- knot one leg tightly at the very top and cut it off below the knot;
- knot the other leg at the knees or below;
- lash the twisted ends of the coat hanger to the broom handle (or stick) with an extra length of wire.

Planning the Activity

Locate two areas to compare with one another: one managed by people and one unmanaged, weedy, and large enough to allow the class to work in teams of two with plenty of space for each team. An undisturbed roadside or railroad right-of-way are good possibilities. The managed area might be a grassy area of the school grounds.

In order that comparisons between the two areas be accurate, the class should decide how many sweeps with their net each team will make in each of the two areas (4 or 5 sweeps is suggested). Decide, too, how much time will be spent

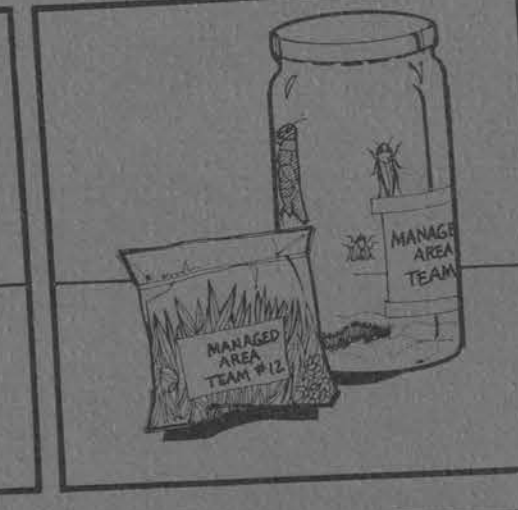
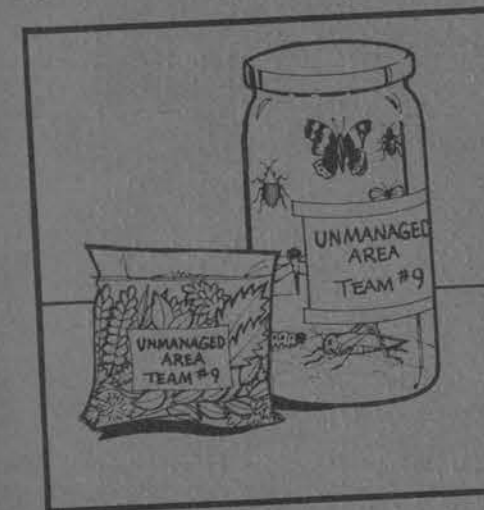
looking on the ground in each area for crawling insects (5 minutes is suggested). Finally, decide how many different plants to collect at each area (5-10 is suggested).

Activity Description

When the class arrives at the weedy area, assign each team to a generous space. First teams should collect one example of each of 5 or 10 plants; pick the plants at ground level, place them in a bag, and mark the bag with their names. Then they should make the agreed upon number of sweeps with their nets, being careful to sweep at a different level and a different place

each time. Next examine the ground for crawling insects, and collect them for the length of time agreed upon. Transfer all insects to killing jars, and mark the jars with team names and location. Leave the insects in the jars for at least an hour.

The procedure can be repeated when the class moves to the school lawn. Here, all sweeps will have to be made at grass level. Spend the same amount of time collecting crawling insects. Again, transfer to killing jars and mark the jars. In collecting plants, it may be impossible to locate 5 to 10 different kinds. Perhaps students will have to collect 5 to 10 grass plants.



INTRODUCTION:

A discussion of information related directly to the activity with suggestions for assistance, if needed.

A removable sheet on which students record their findings. These may be duplicated.

Data Sheet

SIDE ONE

Outdoor Classroom Guide Number 4
Insects and Plants

Date _____ Team _____

Names _____

Collecting Area _____

[illegible]

USING THE DATA:

Data collected during the investigation are used in various ways for discussion and

interpretation. Discussion questions are included.

Using the Data

Back in the classroom, make two large displays: one of unmanaged area plants and insects, and one of managed area plants and insects. Cover two tables (one for each area) with white paper, and draw columns on the paper as illustrated on the Data Sheet. It will not be necessary to know the varieties of insects by name. Divide the entire class collection from each area on the basis of look-alikes, e.g. ants, beetle-types, butterfly and moth-types, etc. Line them up in the columnar areas. On the other half of the table, arrange the plants collected from the same area.

This process could be followed first by individual teams and then a group display could be made using all of the information from the entire class.

With this visualization of diversity in front of them, students can begin to ask themselves some questions:

- Which area shows more insect diversity; plant diversity?
- What could attract insects to an area? Is it variety? Plant height and size? Plant color? Might it be food supply? Shelter? Temperature? A combination of reasons?
- If this great diversity exists when people leave an area alone to grow and develop naturally, what do you think the plant and insect life was like here 150 years ago?
- What effect on insect variety does a cultivated flower garden have? A field of corn?

for information

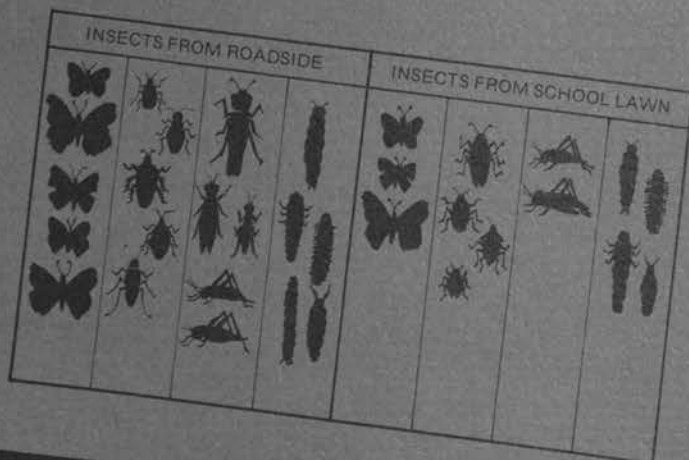
Many Service areas provide shelter, food, water and limited equipment for people. For trip reservations and further information, contact your local U.S. Fish and Wildlife Service office or the following regional Service offices.



after the investigation

Students might be interested in knowing what the names of their insects are. If so, they could use a field guide to insects to identify and label them.

They might make a more permanent display of their collection which could be designed in such a way that it would be artistic, while still illustrating the concept of diversity. Plants and insects could be glued to heavy paper in an approximation of their natural appearance, like this:



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Region I P.O. Box 3737
Portland, OR 97208

Region II P.O. Box 1306
Albuquerque, NM 87103

Region III Federal Building
Ft. Snelling
Twin Cities, MN 55111

Region IV 17 Executive Pk. Dr. NE
Atlanta, GA 30329

Region V John W. McCormack Post
Office and Courthouse
Boston, MA 02109

Region VI P.O. Box 25485
Denver Federal Center
Denver, CO 80225

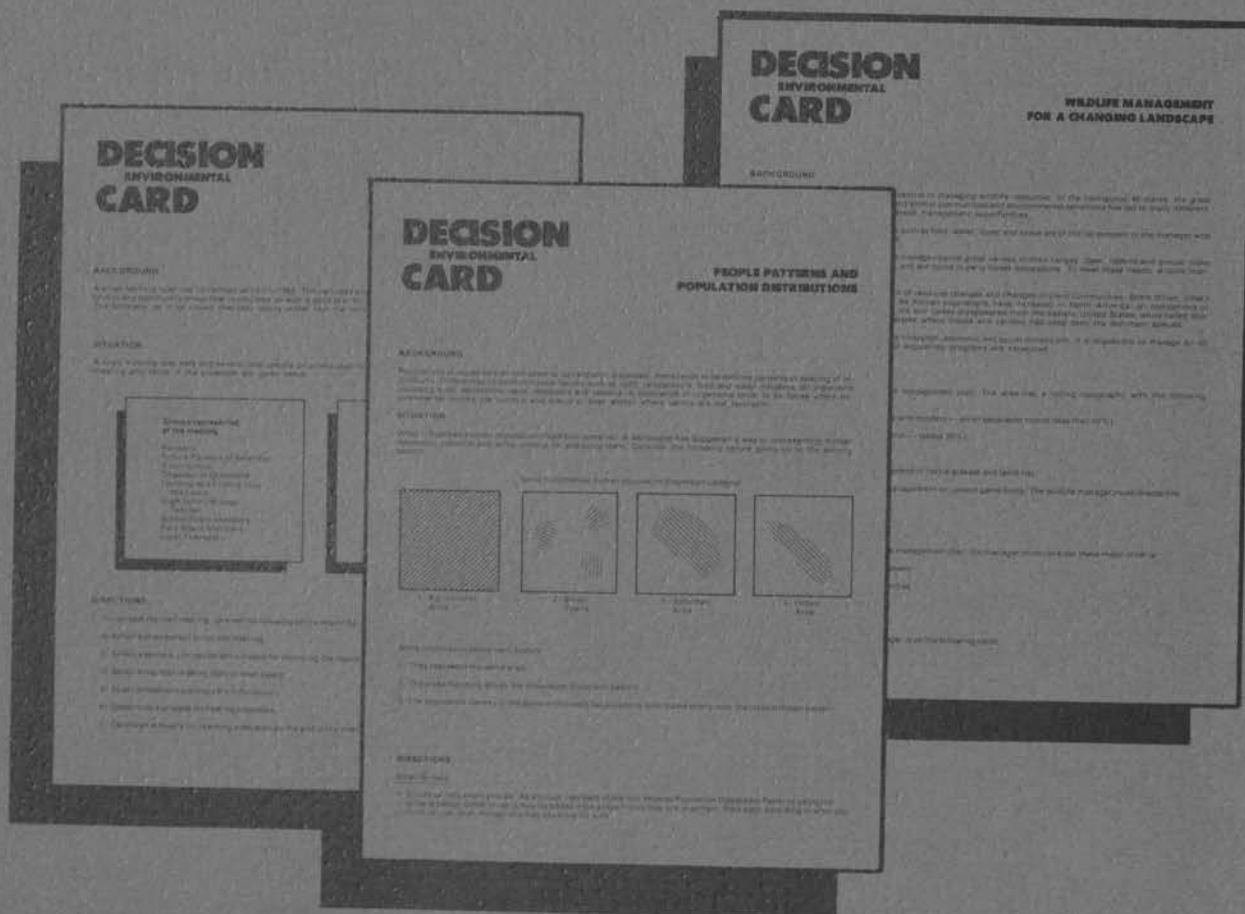
Alaska Area Office
813 D Street
Anchorage, AK 99501

This Outdoor Classroom guide is one of a series; others are available from your local or regional Service representative.

AFTER THE ACTIVITY:

Suggestions for further activities to develop the investigation further for the entire class, or provide independent study material for students with continuing interest.

ENVIRONMENTAL DECISION CARDS



RECOMMENDED FOR GRADES SEVEN-TWELVE

• WHAT ARE THEY?

Each card is a one to two-hour problem-solving activity concerning a land-use or wildlife management issue. The issue is described along with conflicting or opposing viewpoints. Role playing and small group discussion are used to consider the viewpoints before arriving at a decision.

• WHAT'S THEIR PURPOSE?

These cards were written to help build skills in problem solving. The process of reaching a decision when opposing viewpoints and alternative solutions are con-

sidered provides practice in group communication and objective thinking. These cards are also useful as introductory activities to the Investigative Outdoor Classroom Guides.

• HOW ARE THEY USED?

The cards are not developed as teacher-presented materials. Instead, a small group of students should be able to carry out the activities on an independent basis. It is suggested that several small groups deal with the same activity and then share their decisions with the entire group. This should result in a free exchange of ideas and a better understanding of the issue.

BACKGROUND:

A brief description of the issue and pertinent background information.

DECISION ENVIRONMENTAL CARD

PEOPLE PATTERNS AND POPULATION DISTRIBUTIONS

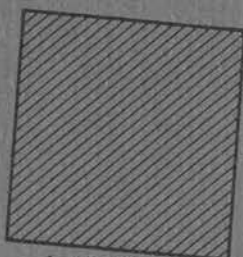
BACKGROUND

Populations of organisms do not seem to be randomly dispersed; there tends to be definite patterns of spacing of individuals. Differences in environmental factors such as light, temperature, food and water influence all organisms including ants, dandelions, cacti, elephants and bacteria. A population of organisms tends to be dense where environmental factors are optimal and scarce or even absent where factors are not favorable.

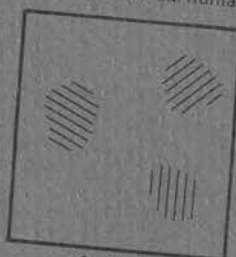
SITUATION

What influences human population dispersion patterns? A sociologist has suggested a way of representing human dispersion patterns and some criteria for analyzing them. Consider the following before going on to the activity section.

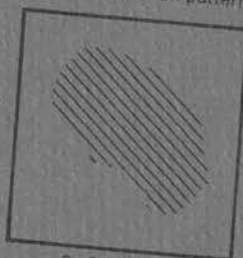
Some hypothetical human population dispersion patterns:



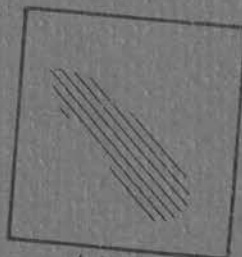
1 - Agricultural Area



2 - Small Towns



3 - Suburban Area



4 - Urban Area

Some information about each square:

1. They represent the same area.
2. The cross-hatching shows the population dispersion pattern.
3. The population density is the same within each square and is distributed evenly over the cross-hatched pattern.

DIRECTIONSSmall Groups:

1. Divide up into small groups. As a group, rate each of the four Human Population Dispersion Patterns using the criteria below. Other criteria may be added if the group thinks they are important. Rate each according to what you think is true, even though you may not know for sure.

SITUATION:

The specific problem which creates the need for decision.

DIRECTIONS:

A step-by-step procedure for the activity with discussion questions.

DECISION ENVIRONMENTAL CARD

WILDLIFE MANAGEMENT FOR A CHANGING LANDSCAPE

BACKGROUND

Problems of land and water use are central to managing wildlife resources. In the contiguous 48 states, the great variation in the composition of plant and animal communities and environmental conditions has led to many different, challenging and sometimes controversial management opportunities.

Factors which limit population growth such as food, water, cover and space are of critical concern to the manager who seeks to lessen their adverse effects.

Many species of wildlife for which we manage require great variety in their ranges. Deer, rabbits and grouse make extensive use of openings and edges, and are found in early forest successions. To meet these needs, wildlife managers mix habitat types.

Animal populations change as a result of land-use changes and changes in plant communities. Some thrive; others become scarce and even disappear. As human populations have increased in North America, all populations of animals have been affected. Wolves, elk and turkey disappeared from the eastern United States; white-tailed deer extended their range into the lake states where moose and caribou had once been the dominant species.

The question of management includes biological, economic and social dimensions. It is impossible to manage for all species. Habitat restoration and land acquisition programs are expensive.

SITUATION

ENVIRONMENTAL DECISION CARD TITLES

1.
Wildlife Management for a Changing Landscape
2.
People Patterns and Population Distributions
3.
School Site Development
4.
Land Donation
5.
Predator Control

DECISION ENVIRONMENTAL CARD

WILDLIFE MANAGEMENT FOR A CHANGING LANDSCAPE

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The question of management includes biological, economic and social dimensions. It is impossible to manage for all species. Habitat restoration and land acquisition programs are expensive.

SITUATION

A large land area requires a wildlife management plan. The area has a rolling topography with the following description:

Medium age stands of hardwoods with conifers — small separated stands (less than 10%)

Mixed age stands of aspen and birch — (about 20%)

Woody shrubs — (over 50%)

Clearings — (about 10%) — composed of native grasses and tame hay.

One aspect of the plan must include management for upland game birds. The wildlife manager must choose one species from these three possibilities:

- a) Prairie Chicken
- b) Sharp-tail Grouse
- c) Ruffed Grouse

In choosing a species and developing a management plan, the manager must consider these major criteria:

- 1) The economics of land management
- 2) The economics of local communities
- 3) Public recreational needs
- 4) Public concerns

The information collected by the manager is on the following cards.

WILDLIFE SURVIVAL GAMES

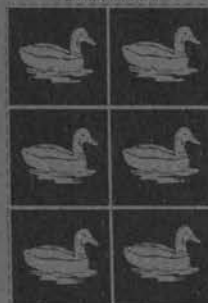
DUCK GAME

Three toy-wood duck raft the pond. Each raft possesses no ducklings. The ducklings must get to the water and find food and shelter to live. There are many dangers in the lives of ducks.

DIRECTIONS

1. Use one spinner and a playing token for each player. Start game in position at token.
2. Put playing token on numbered token.
3. Player with token for 1 duck raft, take which token on same number of squares to move.
4. Player must follow directions on sign which token lands on. The player then go either way around the pond when the token lands on the first square. "Caution: Shading Tokens".
5. Each time a player loses a duck, remove one duck on score sheet after that player's name. A player who loses all ducks must drop out of the game.
6. Continue playing until all players have reached 100% duck. Player finishing with most surviving ducks is the winner. If two players have the same number of ducks left, the one who left to finish first is the winner.

PLAYER TOKENS

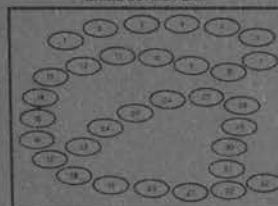


SCORE SHEET

NAME	Number of Ducks						Total Surviving Ducks
	1	2	3	4	5	6	
1							
2							
3							
4							
5							
6							



GAME BOARD PLAN



GAME SITUATION STATEMENTS



RECOMMENDED FOR GRADES 4-6

•WHAT ARE THEY?

These are five independent indoor activities for small groups of 2-6 players. Each game is complete and consists of a game board, a sheet of game materials and a reproducible direction and score sheet. The games depict some environmental factors which influence the lives of five wildlife species: the fox, the eagle, the white-tailed deer, the squirrel and the duck. The players start the game with an equal number of one of the wildlife species. As they move along the game board according to the numbers on a spinner, positive and negative environmental factors are encountered. The player who finishes with the greatest number of individuals remaining is the winner.

•WHAT'S THEIR PURPOSE?

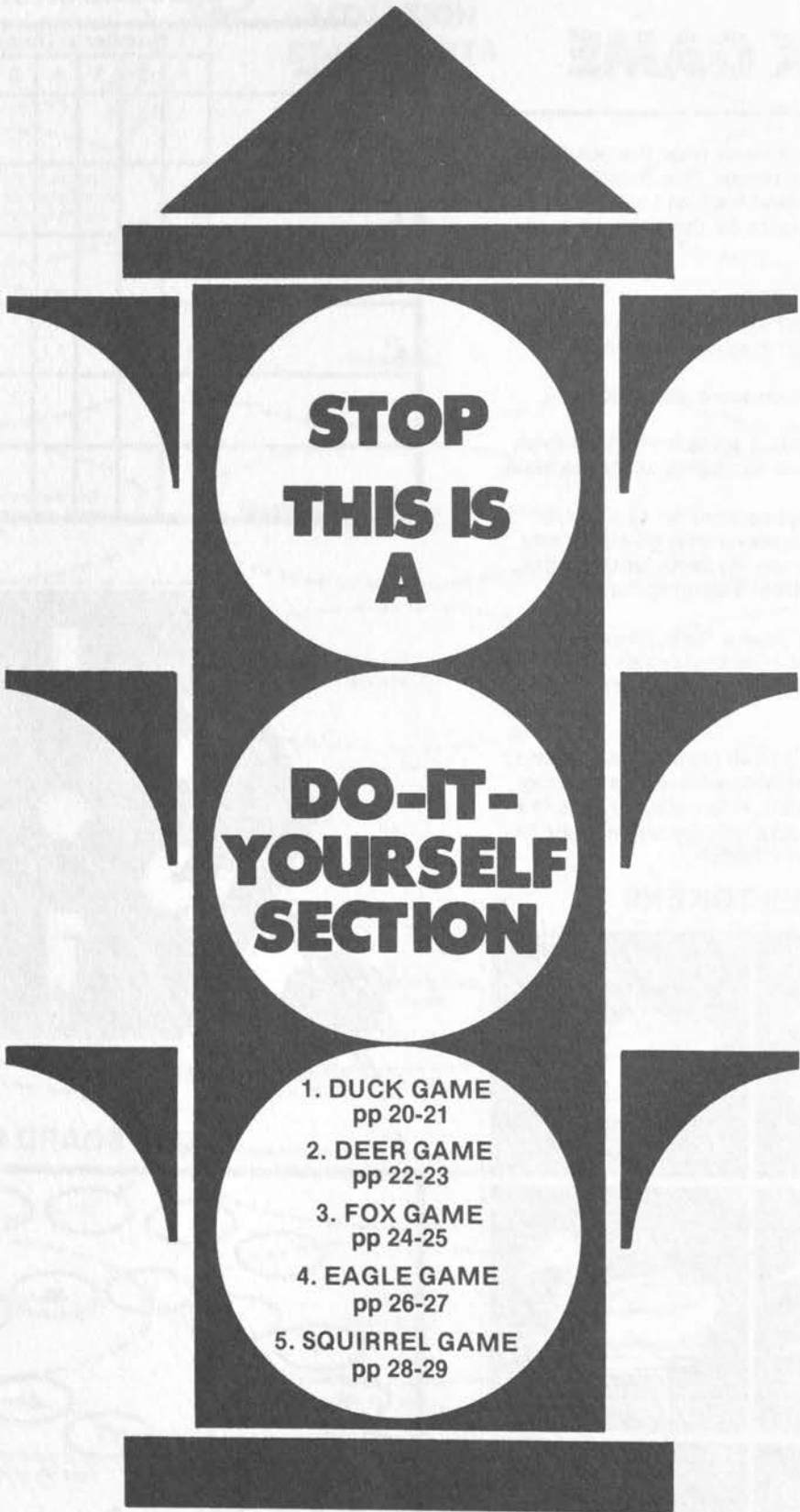
While playing the games, students become acquainted with some of the interactions between living things and

the environment. These interactions include predator-prey relationships, the need for shelter, accidents, the effects of pollution, and the activities of humans. This information is related to the content of some of the Level I Outdoor Classroom Guides. This provides for learning continuity from the indoor activities to the more complex, outdoor investigations.

•HOW ARE THEY USED?

It is recommended that the games be set up as independent activities. If students can read the directions they should be able to play the games without adult assistance. The situations depicted in each game are factual and relate to a particular concept or problem. Many of the situations could serve as the basis for discussion once students have completed a game. The games may also serve as pre-activities to the Outdoor Classroom Guides.





**STOP
THIS IS
A**

**DO-IT-
YOURSELF
SECTION**

1. DUCK GAME
pp 20-21
2. DEER GAME
pp 22-23
3. FOX GAME
pp 24-25
4. EAGLE GAME
pp 26-27
5. SQUIRREL GAME
pp 28-29

Portions of each Wildlife Survival Game need to be photo-copied
before they can be assembled.

GO

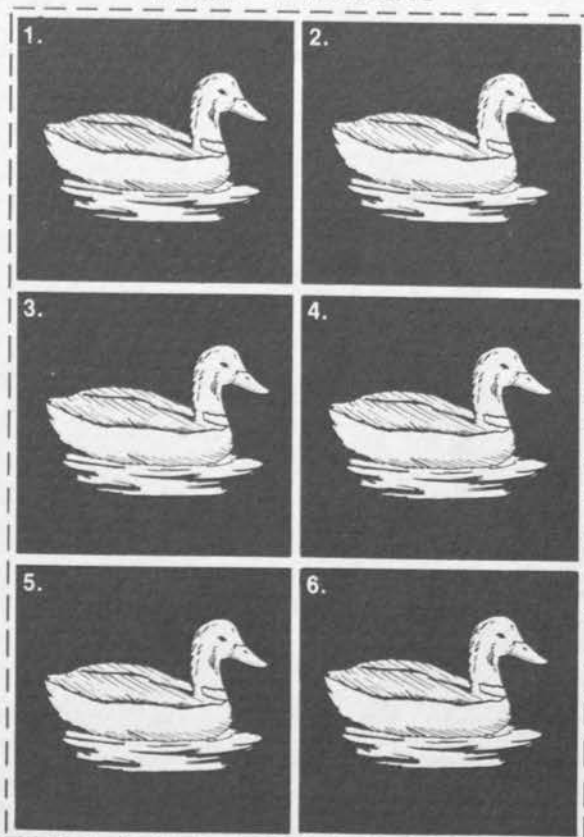
DUCK GAME

There are several duck nests near the pond. Each nest produced six ducklings. The ducklings must get to the water and find food and shelter to live. There are many dangers in the lives of ducks.

DIRECTIONS

1. Use one spinner and a playing token for each player. Insert pencil in spinner as shown.
2. Put players' names on score sheet below.
3. Player with token No. 1 spins first. Side which lands on table shows number of spaces to move.
4. Player must follow directions on step which token lands on. The player may go either way around the pond when the token lands on the step labeled "Caution: Snapping Turtle."
5. Each time a player loses a duck, cross out one duck on score sheet after that player's name. A player who loses all six ducks must drop out of the game.
6. Continue playing until all players have reached FINISH. **Player finishing with most surviving ducks is the WINNER.** If two players have the same number of ducks left, the one who got to FINISH first is the WINNER.

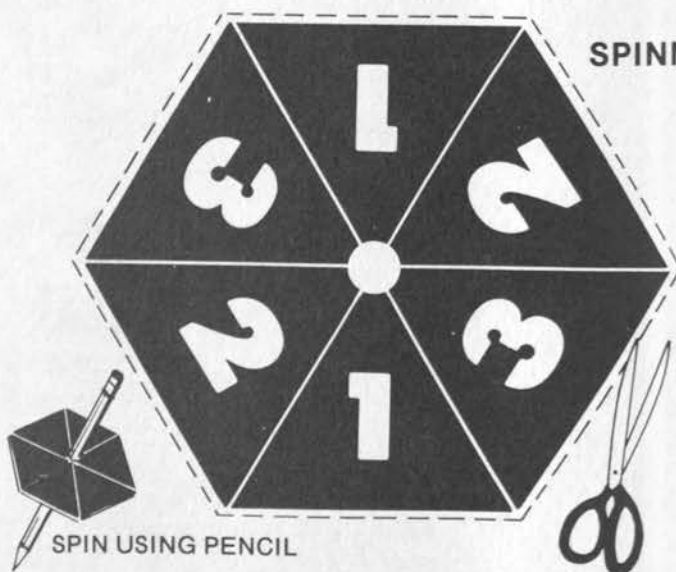
PLAYER TOKENS



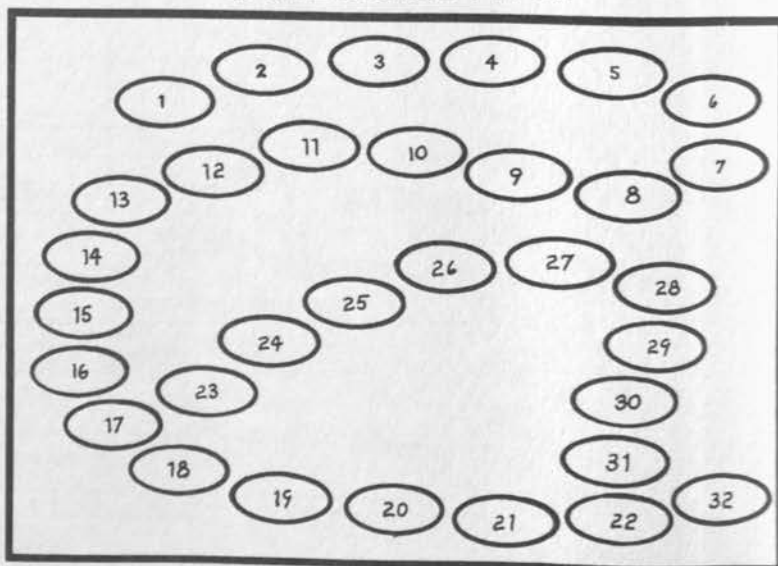
SCORE SHEET

Name	Number of Ducks						Total Surviving Ducks
	1	2	3	4	5	6	
1.							
2.							
3.							
4.							
5.							
6.							

SPINNER



GAME BOARD PLAN



GAME SITUATION STATEMENTS



1.
START

2.
Soon after the ducklings hatch, a house cat finds the nest and takes one duckling before the mother duck scares it away. **Cross out one duckling.**

3.
Blank space.

4.
Tall grass protects the mother duck and ducklings on their way to the pond. **Move ahead 2 spaces.**

5.
Blank space.

6.
Blank space.

7.
The pond has been drained for crops; they must find another pond. **Go back to start.**

8.
Blank space.

9.
Two ducklings are chased and caught by a boy and girl and taken home. **Cross out 2 ducklings.**

10.
The weather is cold and wet for several days; not many insects are hatching. **Go back 2 spaces.**

11.
There are many insects for the ducklings to eat. **Move ahead 2 spaces.**

12.
Blank space.

13.
Blank space.

14.
Spraying for mosquitos kills many insects. **Move back 2 spaces.**

15.
Blank space.

16.
Blank space.

17.
Caution: Snapping Turtle
Take a chance
or
Detour

18.
Eaten by a large snapping turtle which lives in the pond. **Cross out 1 duckling.**

19.
Blank space.

20.
Cattails and other plants in the pond protect the ducklings. **Move ahead 1 space.**

21.
Blank space.

22.
Blank space.

23.
Blank space.

24.
Blank space.

25.
Blank space.

26.
A grass fire burns some of the cattails on the edge of the pond. **Move back 1 space.**

27.
Grain crop near pond. **Move ahead 3 spaces.**

28.
Blank space.

29.
Blank space.

30.
Blank space.

31.
Ducklings use muskrat houses for resting in the sun. **Moved ahead 1 space.**

32.
FINISH

DEER GAME

The large area shown on the game board is "home" for several deer. Here the deer must find food, water and shelter in order to survive. There are many dangers in the lives of deer and many do not survive. This may seem bad at first, but it is important to know that if some deer didn't die there would soon be too many deer in the area. When this happens they can starve or become sick.

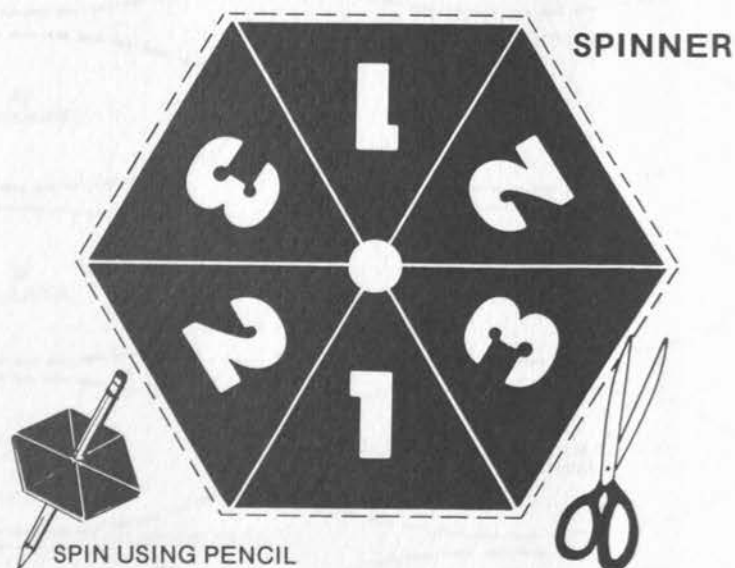
DIRECTIONS

1. Use one spinner and a playing token for each player. Insert pencil in spinner as shown.
2. Put player's names on score sheet below.
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4. Player must follow directions on step which token lands on.
5. Each time a player loses a deer, cross out one deer on score sheet after that player's name. A player who loses all 10 deer must drop out of the game.
6. Continue playing until all players have reached FINISH. Player finishing with most surviving deer is the WINNER. If two players have the same number of deer left, the one who got to FINISH first is the WINNER.



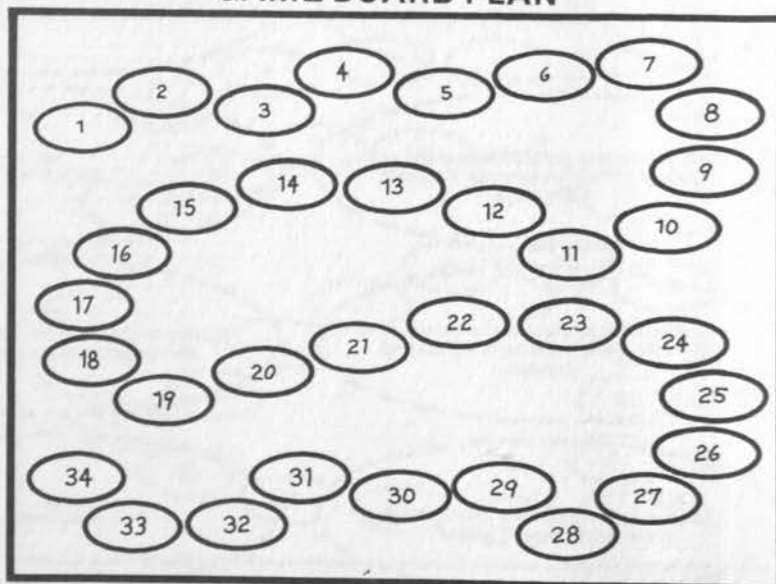
SCORE SHEET

Name	Number of Deer										Total Surviving Deer
	1	2	3	4	5	6	7	8	9	10	
1.											
2.											
3.											
4.											
5.											
6.											



SPIN USING PENCIL

GAME BOARD PLAN



1.
START

2.
Blank space.

3.
The deer population is too large for the food supply. Three deer are taken during the hunting season. **Stay where you are.**

4.
Many fawns have survived the summer; there are too many deer in the area. **Go back 2 spaces.**

5.
A farmer doesn't pick all of his corn, leaving some for wildlife food. **Move ahead 2 spaces.**

6.
Blank space.

7.
Blank space.

8.
Dense evergreen trees provide protection from winter winds. **Move ahead 2 spaces.**

9.
In the winter, deer depend on the woody twigs of certain trees and shrubs for food. There is an abundance of these trees and shrubs in the area. **Move ahead 3 spaces.**

10.
Blank space.

11.
Blank space.

12.
Blank space.

GAME SITUATION STATEMENTS

13.
The snow is too deep for the deer to uncover food on the ground. **Go back 2 spaces.**

14.
Two deer are chased and killed by dogs. **Cross out 2 deer.**

15.
Deer are chased by snowmobilers. **Go back 3 spaces.**

16.
There are too many deer in the area; they begin to run out of food. **Cross out 3 deer.**

17.
Cold, wet weather weakens a fawn and it dies of sickness and parasites. **Cross out 1 deer.**

18.
There is an abundance of early green growth for food. **Move ahead 2 spaces.**

19.
Blank space.

20.
Blank space.

21.
A doe is killed by a car; her fawn cannot survive alone and dies also. **Cross out 2 deer.**

22.
Many fawns are born in the area. **Stay where you are.**

23.
Blank space.

24.
Blank space.

25.
Deer use dense underbrush for protection; several acres burn near the river bank. **Go back 1 space.**

26.
Blank space.

27.
Blank space.

28.
Deer eat acorns for food. A large grove of oak trees is bulldozed to make a new farm field. **Go back 2 spaces.**

29.
A large farm field is no longer plowed. Small trees and shrubs begin to take over. **Move ahead 1 space.**

30.
Blank space.

31.
A new highway opens and deer must cross it to get to their food source. Two deer are killed while crossing the highway. **Cross out 2 deer.**

32.
Deer make use of several agricultural crops for food. **Move ahead 2 spaces.**

33.
Blank space.

34.
FINISH

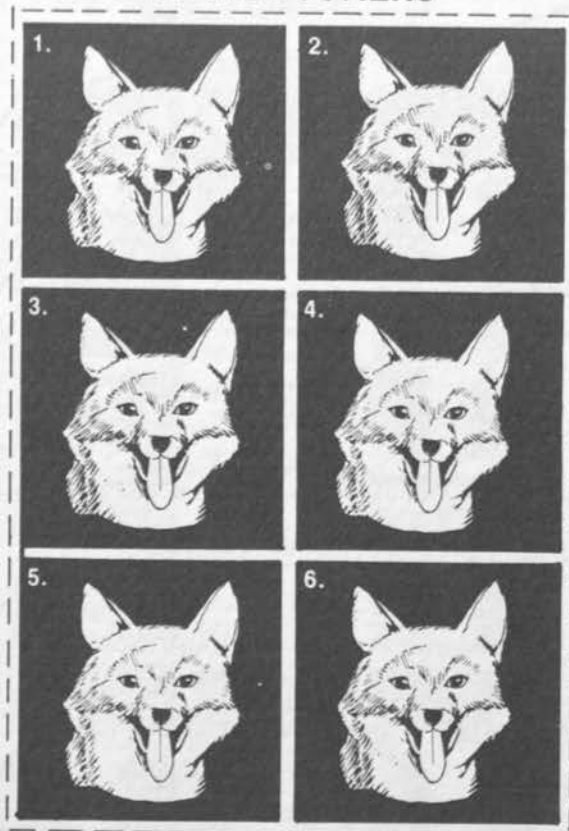
FOX GAME

The red fox must live where it can find food, water and shelter. It eats a great variety of animals and some plants. The number of foxes in an area depends on the abundance of food and other factors which effect its survival. Play the game and find out how many of your young foxes survive.

DIRECTIONS

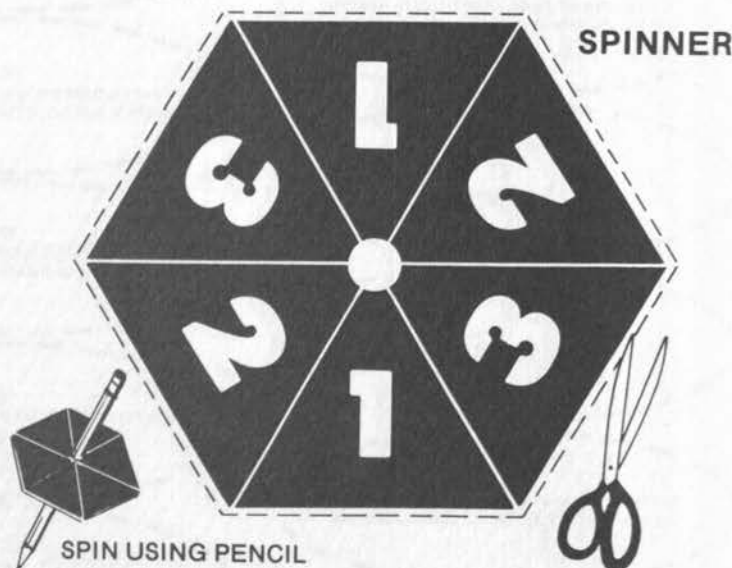
1. Use one spinner and a playing token for each player. Insert pencil in spinner as shown.
2. Put players' names on score sheet below.
3. Player with token No. 1 spins first. Side which lands on table shows number of spaces to move.
4. Play must follow directions on step which token lands on.
5. Each time a player loses a fox, cross out one fox on score sheet after that player's name. A player who loses all six foxes must drop out of the game.
6. Continue playing until all players have reached **FINISH**. Player finishing **with most surviving** foxes is the **WINNER**. If two players have the same number of foxes left, the one who got to **FINISH** first is the **WINNER**.

PLAYER TOKENS

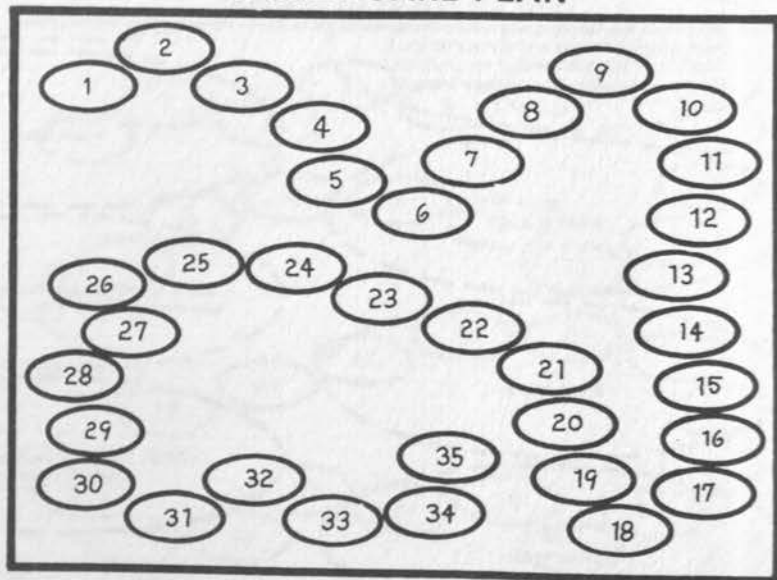


SCORE SHEET

Name	Number of Foxes						Total Surviving Foxes
	1	2	3	4	5	6	
1.							
2.							
3.							
4.							
5.							
6.							



GAME BOARD PLAN



GAME SITUATION STATEMENTS



1.
START

2.
Field mice population has exploded! Plenty to eat. **Move ahead 3 spaces.**

3.
Blank space.

4.
Farmers conduct a den hunt and destroy fox pups. **Cross out 1 fox.**

5.
Blank space.

6.
Good den locations. Brushy cover, sandy soil, woods and field. **Move ahead 4 spaces.**

7.
Blank space.

8.
Blank space.

9.
Food needs increase as pups are born. **Go back 1.**

10.
Blank space.

11.
Grasshoppers and other insects killed by insecticides. **Go back 1.**

12.
Roadside wild fruits and berries killed by poison sprays. **Go back 4.**

13.
Blank space.

14.
Population of foxes too large and disease sets in. Lose 1 fox to rabies. **Cross out 1 fox.**

15.
Blank space.

16.
Plenty of berries. Living is easy. **Move ahead 2.**

17.
Blank space.

18.
Blank space.

19.
Scavenging of road kills provides good addition to diet. **Move ahead 2.**

20.
June bugs and grasshoppers are plentiful. Together with fruits and berries they satisfy hunger. **Move ahead 4.**

21.
Blank space.

22.
Young foxes are forced out of their parents' territory. Lose 1 fox hit by a car as it crosses unfamiliar road. **Cross out 1 fox.**

23.
Price for fox pelts soars! Trapping increases. **Cross out 1 fox.**

24.
Blank space.

25.
Great fall fruit and insect crop. Won't have to chase speedy cottontail! **Move ahead 3 spaces.**

26.
The ground in the apple orchard is covered with apples. **Move ahead 4 spaces.**

27.
Blank space.

28.
Blank space.

29.
Blank space.

30.
Blank space.

31.
Winter of little snow helps fox escape hunters. **Move ahead 1 space.**

32.
Blank space.

33.
Abundant snow cover aids fox hunters. Foxes cannot run fast in deep snow. **Cross out 1 fox.**

34.
High rabbit population. Plenty of winter food. **Move ahead 1 space.**

35.
FINISH

EAGLE GAME

The bald eagle lives only in North America. It is the second largest North American bird of prey, weighing up to 16 pounds with a wing span of from six to eight feet.

Primarily fish-eating birds, they are found along the coasts of North America and along inland lakes and rivers from the Gulf of Mexico to the Arctic.

Today the bald eagle is fighting for its life. Most of the remaining bald eagles nest in Canada or Alaska. Only about 750 pairs still nest south of the Canadian border.

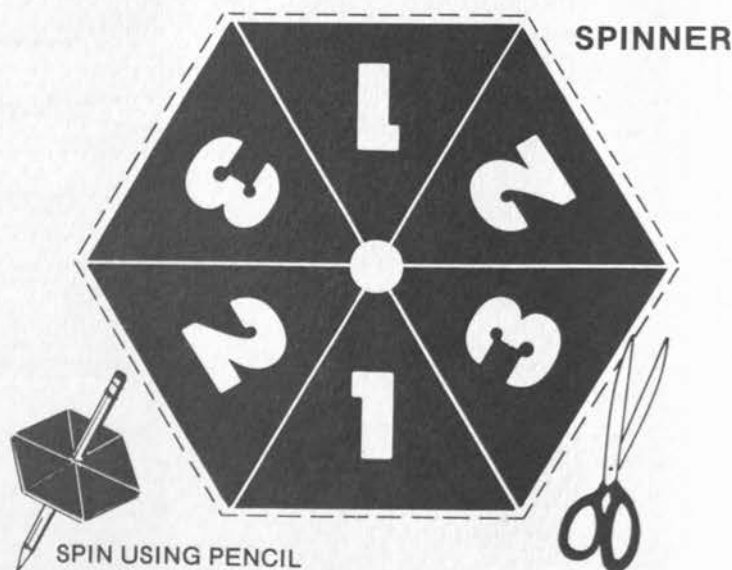
DIRECTIONS:

1. Use one spinner and a playing token for each player. Insert pencil in spinner as shown.
2. Put players' names on score sheet below.
3. Player with token No. 1 spins first. Side which lands on table shows number of spaces to move.
4. Player must follow directions on step which token lands on.
5. Each time a player loses an eagle, cross out one eagle on the score sheet after that player's name. A player who loses all 10 eagles must drop out of the game.
6. Continue playing until all players have reached FINISH. Player finishing with most surviving eagles is the WINNER. If two players have the same number of eagles left, the WINNER is the one who came to FINISH first.

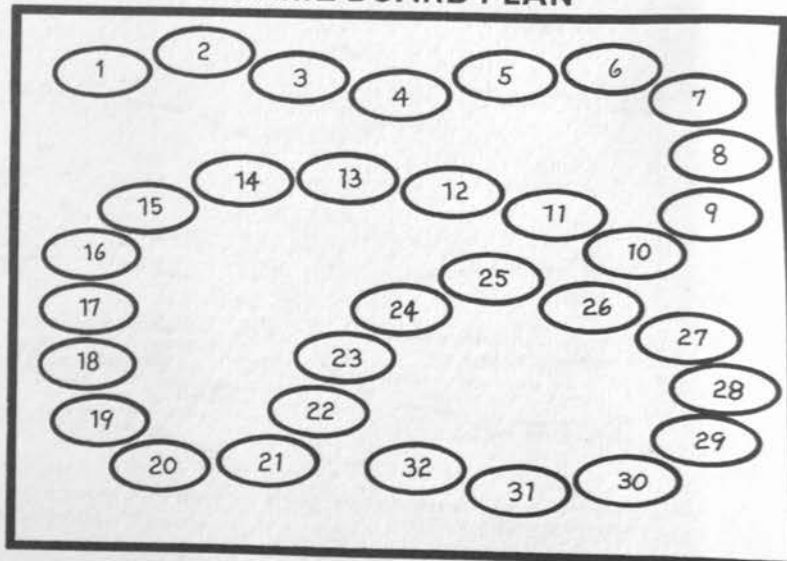


SCORE SHEET

Name	Number of Eagles										Total Surviving Eagles
	1	2	3	4	5	6	7	8	9	10	
1.											
2.											
3.											
4.											
5.											
6.											



GAME BOARD PLAN



GAME SITUATION STATEMENTS



1.
START

2.
From 1917 through 1952, Alaska offered a bounty for bald eagles. **Cross out 3 eagles.**

3.
Alaska enters union in 1959 and federal law forbids killing eagles. **Move ahead 3 spaces.**

4.
Blank space.

5.
Blank space.

6.
Blank space.

7.
Bald eagles do not get their white heads and tails until they are 3½-4½ years old. A hunter shoots a young eagle because he thought it was a "big brown hawk." (It's also illegal to shoot hawks!) **Cross out 2 eagles.**

8.
Clearcutting (removing of all trees from an area) eliminates nesting sites. **Go back 2 spaces.**

9.
Strong winds destroy several nest trees. **Go back 4 spaces.**

10.
Blank space.

11.
Blank space.

12.
The uses of long-lasting pesticides such as DDT increase greatly since 1947. These pesticides are passed on through food chains and build up to high levels in the bodies of meat eaters such as eagles. **Go back 6 spaces.**

13.
Federal regulations in the 1970's ban use of predator poisons on federal lands and restrict use on private land. **Move ahead 2 spaces.**

14.
Blank space.

15.
Blank space.

16.
A hunter shoots an eagle because his granddaddy told him they would carry off sheep and even young children. (It's impossible for an eagle to carry more than it's weight, which is 8-16 pounds!) **Cross out 2 eagles.**

17.
Law enacted in 1970's makes shooting wildlife from aircraft unlawful. **Move ahead 2 spaces.**

18.
Blank space.

19.
Blank space.

20.
An increased number of people are using eagle nesting areas for recreation. This disturbance often causes eagles to abandon their nests. **Go back to start.**

21.
Bald Eagle Protection Act amended in the 1970's making penalty for killing bald eagles \$5,000 and/or up to one year in prison. **Go ahead 3 spaces.**

22.
Blank space.

23.
Persistent pesticides other than DDT are still being used. **Cross out 3 eagles.**

24.
Blank space.

25.
Development of waterfront land increases taking much natural bald eagle habitat. **Go back 3 spaces.**

26.
Conservation groups secure cooperation of utility companies to modify existing power lines and put safeguards on new lines to stop electrocution of bald eagles. **Go ahead 2 spaces.**

27.
Blank space.

28.
Blank space.

29.
High levels of pesticides in the bodies of female eagles may kill the developing embryos in the eggs. **Cross out 5 eagles.**

30.
Most uses of DDT are banned in 1972. **Go ahead 2 spaces.**

31.
Blank space.

32.
FINISH

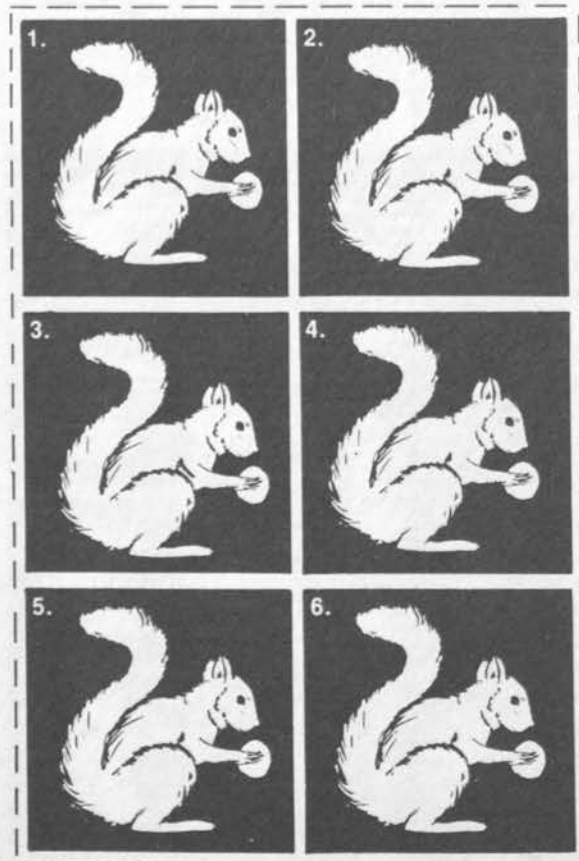
SQUIRREL GAME

Many squirrels live in wooded city parks. The squirrels must find food and shelter here in order to survive. There are many dangers in the lives of squirrels.

DIRECTIONS

1. Use one spinner and a playing token for each player. Insert pencil in spinner as shown.
2. Put players' names on score sheet below.
3. Player with token No. 1 spins first. Side which lands on table shows number of spaces to move.
4. Player must follow directions on step token lands on.
5. Each time a player loses a squirrel, cross out one squirrel on score sheet after that player's name. A player who loses all six squirrels must drop out of the game.
6. Continue playing until all players have reached FINISH. Player finishing with **most surviving squirrels** is the WINNER. If two players have the same number of squirrels left, the one who got to FINISH first is the WINNER.

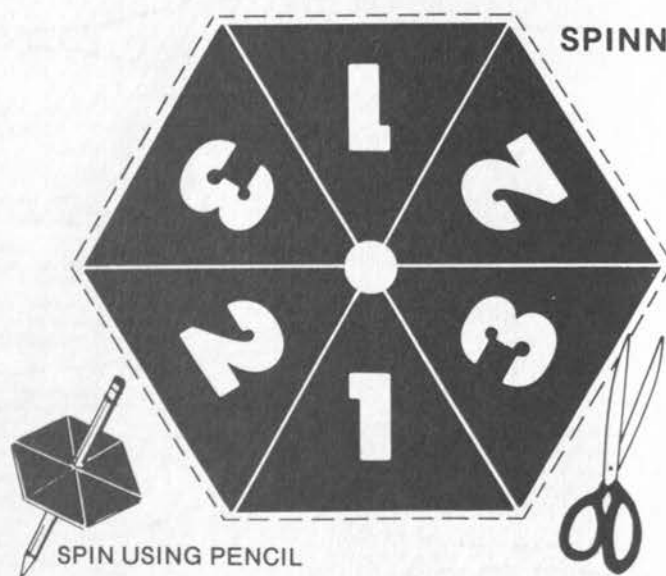
PLAYER TOKENS



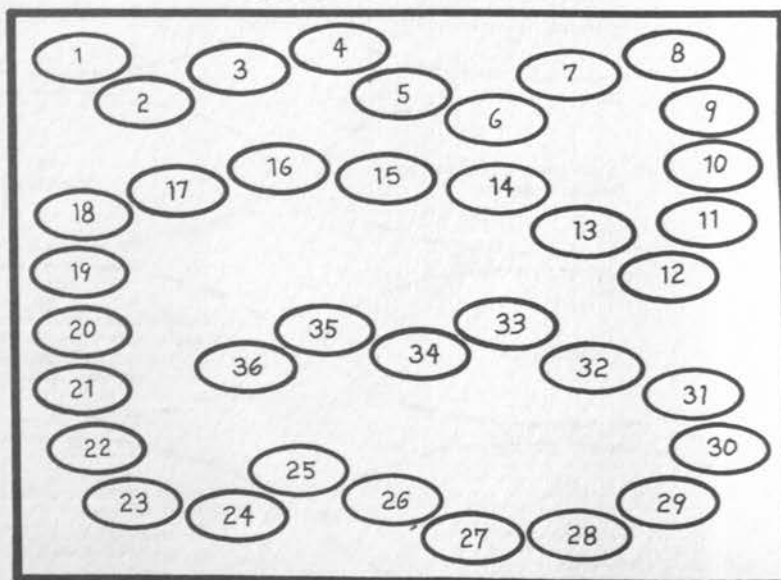
SCORE SHEET

Name	Number of Squirrels						Total Surviving Squirrels
	1	2	3	4	5	6	
1.							
2.							
3.							
4.							
5.							
6.							

SPINNER



GAME BOARD PLAN



GAME SITUATION STATEMENTS



1.
START

13.
Blank space.

25.
Blank space.

2.
A squirrel sees the jerking tail of an alarmed squirrel followed by warning bark and is able to escape a house cat. **Move ahead 1 space.**

14.
Community members organize and stop the destruction of a large grove of oak trees. Squirrel homes and food are saved. **Move ahead 3 spaces.**

26.
Nuts from last fall are gone. Squirrels search for fruits, berries, and early spring greenery and find very little. **Go back 2 spaces.**

3.
Blank space.

15.
There are few predators that are very good at hunting squirrels. However, a weasel is small enough to get in the den door and it kills a squirrel. **Cross out 1 squirrel.**

27.
Community members realize that leaving some underbrush in their oak covered park provides shelter for squirrels. **Move ahead 3 spaces.**

4.
Squirrels eat corn scattered by people in the park neighborhood. People quit giving squirrels corn because they decided squirrels were a nuisance. **Cross out 1 squirrel.**

16.
Blank space.

28.
Blank space.

5.
A squirrel's body is designed so it can jump from great heights without injury. A squirrel jumps 40 feet to the ground to escape a house cat. **Move ahead 2 spaces.**

17.
Blank space.

29.
Blank space.

6.
Squirrels are a favorite target for kids and adults armed with sling shots, air rifles, BB guns and rocks. **Cross out 1 squirrel.**

18.
There are plenty of hardwood trees to provide shelter and escape route for squirrels. **Move ahead 2 spaces.**

30.
Blank space.

7.
Blank space.

19.
Squirrels depend on their sense of smell to find buried nuts when hungry. Slightly moist soil conducts scents best. During a drought year they have difficulty finding buried nuts. **Go back 2 spaces.**

31.
Squirrel runs into street and is killed by a car. **Cross out 1 squirrel.**

8.
Squirrels find a plentiful supply of insects in the tree bark and soil. **Move ahead 2 spaces.**

20.
Blank space.

32.
It is spring and the nuts stored last fall have been dug up and eaten. Because the community left part of the park "wild", there are plenty of fruits and berries. **Move ahead 1 space.**

9.
Kids try to raise a baby squirrel they caught in the spring. They don't know what to feed it. **Cross out 1 squirrel.**

21.
Plenty of oak and hickory trees provide food and places for nests. **Move ahead 3 spaces.**

33.
Blank space.

10.
Blank space.

22.
It has been a long winter with little food. Some squirrels develop mange and other diseases. **Cross out 1 squirrel.**

34.
Blank space.

11.
There are not enough den trees to go around. **Go back to START.**

23.
This park has several ideal den trees. These were formed in old white oaks whose dead limbs hold their bark, absorb moisture and rot quickly, forming safe dens. **Move ahead 2 spaces.**

35.
Over-population causes squirrels to migrate. Now there is more food for those that remain. **Move ahead 1 space.**

12.
Early August brings a good crop of nuts. Squirrels begin to gather and bury them. **Move ahead 1 space.**

24.
Blank space.

36.
FINISH



3

SECTION

MATCHING ACTIVITIES TO YOUR PROGRAM

• CHOOSING WHAT YOU NEED

We have developed these activities using content topics and skills which are common to many programs, whether school-based or not. To help you select the activities that best fit your needs, we have classified the materials into categories. The chart below classifies the three major clusters of materials according to where they are used and appropriate age levels.

OUTDOOR MATERIALS		INDOOR MATERIALS	
	OUTDOOR CLASSROOM GUIDES	ENV. DECISION CARDS	WILDLIFE SURVIVAL GAMES
LEVEL I (GRADES 4-6)	✓		✓
LEVEL II (GRADES 7-12)	✓	✓	

According to the chart there are **Outdoor Classroom Guides** for levels I and II and indoor activities, **Environmental Decision Cards** for level II and **Wildlife Survival Games** for level I. This helps classify each major cluster of materials but does not describe individual activities within each cluster. To describe each activity and to show how activities in different clusters relate to each other, three new categories have been added to the chart. They are **Seasonal Requirements**, **Content Topics** and **Process Skills**. The activities in each cluster have been classified according to these categories on the following two pages. This makes up a classification chart from which you can get a quick description of a single activity or find relationships between two or more activities. As an example, two Outdoor Classroom Guide descriptions from the chart are given on page 34.

Language
15 - Waterfowl Nest Structures
16 - Fire Ecology
17 - Muskrats
18 - Wetlands and Wildlife
20 - Fish Populations
21 - Public Survey
22 - Fish Hatcheries
23 - Farming and Wildlife
24 - Endangered Blackbird Mystery Species



WETLANDS AND WILDLIFE

Level II

- Spring, Summer, Fall
- Environmental factors
- Habitat
- Waterfowl
- Wetlands
- Watershed
- Wildlife management
- Classification
- Data collection
- Interpretation
- Mapping
- Measurement/mathematics



FARMING AND WILDLIFE

Level II

- Winter
- Agriculture
- Environmental factors
- Habitat
- Man and his social history
- Populations - diversity
- Wildlife management
- Classification
- Data collection
- Interpretation
- Mapping
- Measurement/mathematics

MATCHING ACTIVITIES
TO YOUR NEEDS

To decide which cluster of materials to begin with you will need to consider site (indoor vs. outdoor), grade-range and seasonal requirement. Next, scan the Content Topics and Process Skills lists until you find some categories which match your program needs. Identify which activities deal with these categories by linking the check marks to specific activity titles at the top of the chart.

CHECK YOUR STUDENTS
FOR INVESTIGATION SKILLS

Students must be able to use certain investigation skills in order to complete each Outdoor Classroom Guide activity. This may require learning or practicing these skills before beginning an Outdoor Classroom Guide activity. Check the section, **Learning Investigation Skills**, for activities developed to help students with several important skills.

These descriptions indicate that both activities involve investigation of wildlife and habitat. Although the habitats and wildlife species are different, both involve investigations of the relationships between land and wildlife. Using the **Classification Chart** in this way helps you select several related experiences which could take place over several days or weeks.

This chart is also useful for finding relationships between two or more activities among the three major clusters of materials. An indoor activity such as one of the Wildlife Survival Games deals with some of the same content topics as some of the Outdoor Classroom Guides. As an example, the **Duck Game** deals with some of the same content topics as some of the Outdoor Classroom Guides. As an example, the **Duck Game** deals with some of the same environmental factors found in the Outdoor Classroom Guide, **Fish Hatcheries**. This provides a way of relating indoor and outdoor learning experiences. This same process could be used in relating an Environmental Decision Card to an Outdoor Classroom Guide activity.

LEARNING INVESTIGATION SKILLS

• COLLECTING INFORMATION

The Learning outcome of each Outdoor Classroom activity will be dependent on the success of the participants in collecting and using information.

Collecting information is usually best done on an individual or small group basis. These skills often involve using simple measuring devices such as rulers or thermometers, recording information on a data sheet, making a map and making observations and population estimates using small sample plots. When each individual is involved in collecting information, the background for individuals making their own best guesses has been established.

• USING INFORMATION

Using the information once it is collected is just as important as collecting it. Using information tends to be a large group activity where individuals or small groups share or pool information for the purpose of interpreting the results. This, too, requires some learning process skills. The information must be communicated such that it is understood by the entire group; this often involves discussion and questioning. To help interpret further, graphs, charts and other ways of displaying information are often needed. This helps participants understand the information and its use in making inferences and drawing conclusions.

A TRANSECT STUDY

This study will help students learn and practice investigation skills needed for the Outdoor Classroom Guide activities. Although this study is primarily for students in grades 4-9, it will be useful to consider it for other age levels. For students that do not require completing the entire study, individual skills can be selected where the need occurs.

HOW TO BEGIN

A transect study is a way of finding out about an area without having to investigate every square inch of it. A transect is a line established in such a way that it cuts through the area to be investigated. By collecting information at various points along the transect, characteristics of the area can be sampled. Through interpreting the information collected at the stations along the transect, inferences can be made about the nature of the entire area.

The following steps describe a transect study which can be conducted at almost any place.

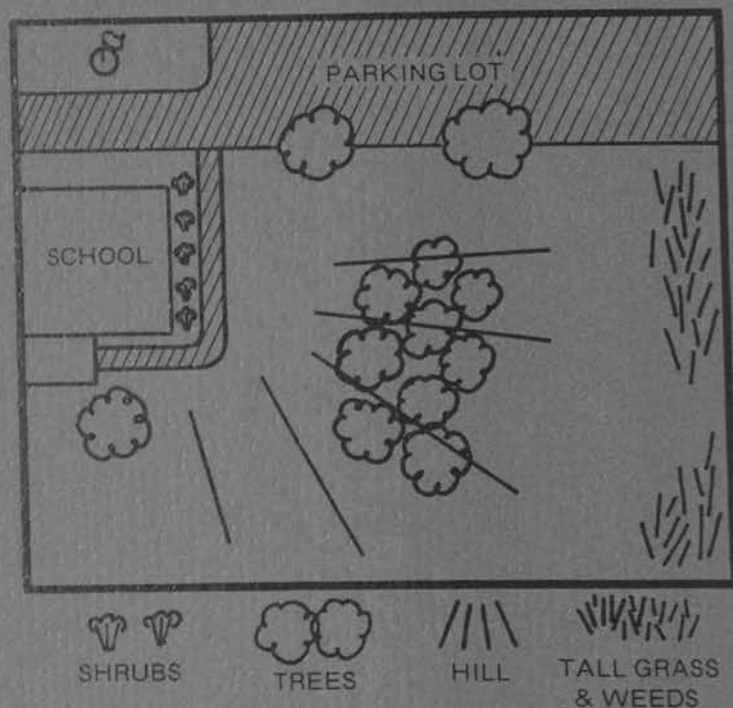
Locate an area where several teams of two or three students can work without getting in each other's way. The area should include some diverse terrain such as a hillside, grove of trees, pond, creek, or even part of a lawn or parking lot. Once a general area has been selected you are ready to begin with step one.

STEP 1

MAPPING

SOME THINGS EACH TEAM SHOULD DO

1. Get to know the general boundaries of the study area. Walk over the area — acquire a feel for land formations, natural and man-made structures.
2. Construct a working map of the area. (Decide on symbols before beginning so that the team maps will be understood by the entire group.)
3. Describe team maps to the entire group.
4. Using individual team maps, a general map should be constructed to serve as the basis for Step 2.

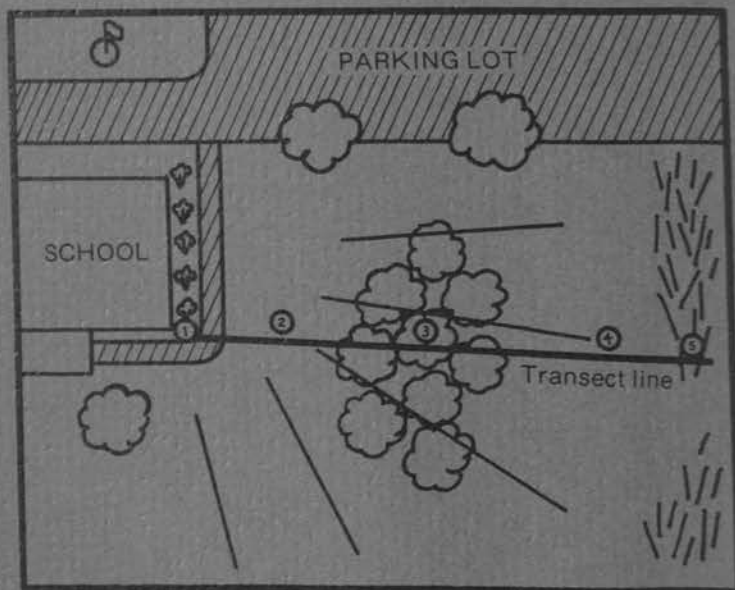


STEP 2

THE TRANSECT LINE/ INFORMATION COLLECTING STATIONS

A GENERAL MAP

1. Decide where the transect line should be.
2. Decide where the information collecting stations should be located along the line.
3. Outside on the study area, mark the transect line. (Wooden lath and ribbon make good markers.)
4. Locate each information collecting station, number and mark it. (Locate stations in areas along the transect line so that a representative cross-section of the area will be studied. Keep them far enough apart so that the teams will not interfere with each other when collecting information.)



①-⑤ Locations of information collecting stations

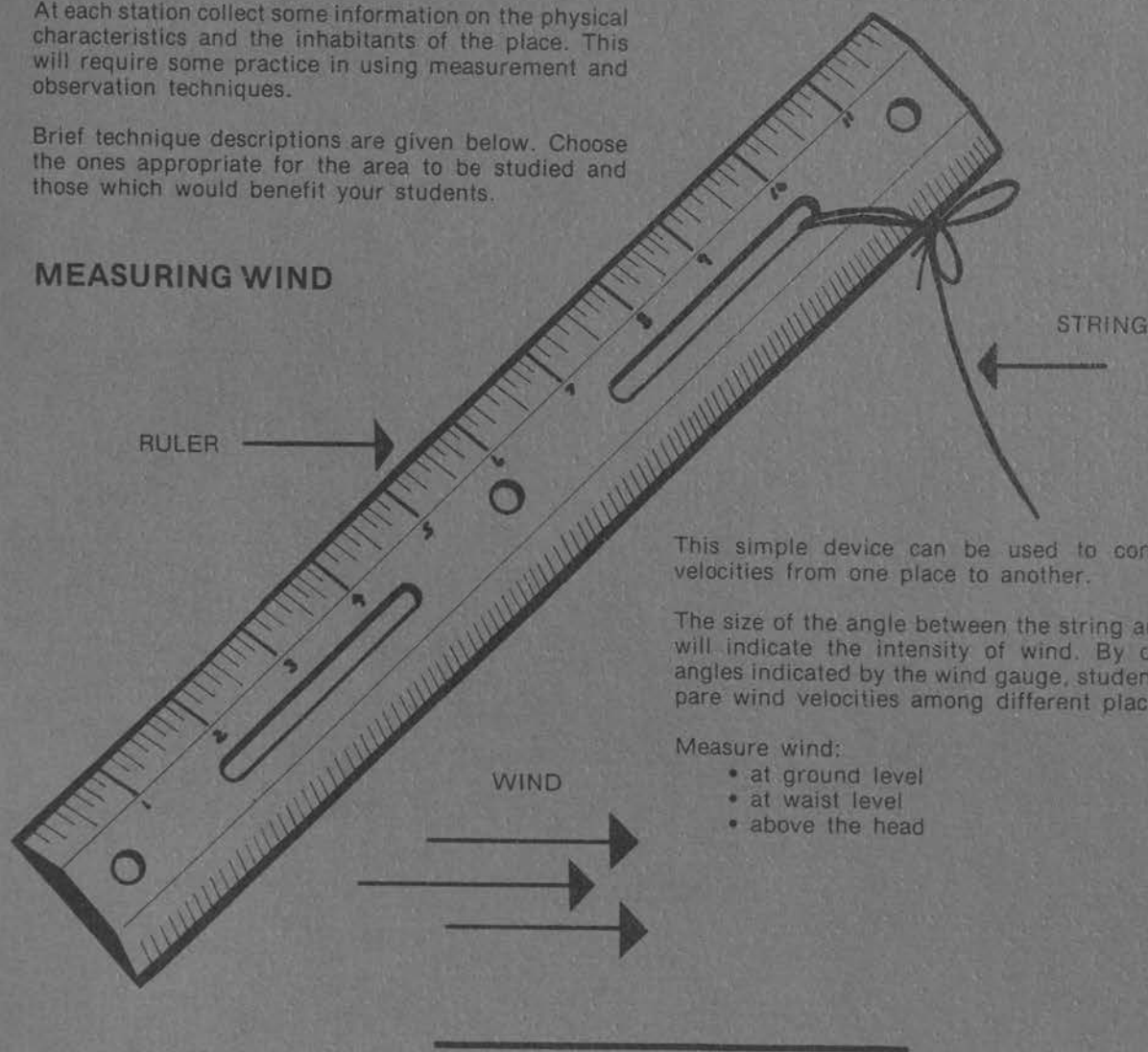
STEP 3

TECHNIQUES FOR COLLECTING INFORMATION

At each station collect some information on the physical characteristics and the inhabitants of the place. This will require some practice in using measurement and observation techniques.

Brief technique descriptions are given below. Choose the ones appropriate for the area to be studied and those which would benefit your students.

MEASURING WIND



This simple device can be used to compare wind velocities from one place to another.

The size of the angle between the string and the ruler will indicate the intensity of wind. By drawing the angles indicated by the wind gauge, students can compare wind velocities among different places.

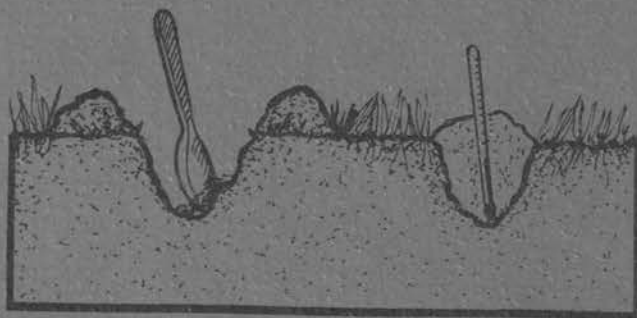
Measure wind:

- at ground level
- at waist level
- above the head

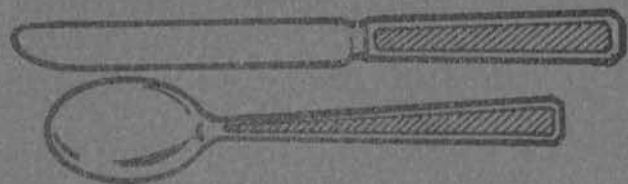
• TAKING TEMPERATURES

Use easy-to-read simple thermometers. It takes about three minutes for a reliable reading to register. Take temperatures at varying levels:

- air temperature, measure at shoulder height
- surface temperature, measure with the thermometer flat on the ground
- soil temperature, measure at about 4 inches below the surface. Use a spoon or knife to make a hole — then gently pack soil back around the thermometer bulb.



DESCRIBING SOIL



The only equipment needed is old spoons or table knives for shallow digging.

MOISTURE



Dry: falls apart and sifts between the fingers

Slightly Moist: appears moist but does not stick together when squeezed

Moist: sticks in a clump when squeezed

Very Moist: squeezes freely and water is obvious

Wet: water drips

TEXTURE



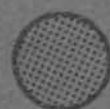
Soil is usually a mixture of varying sizes of particles. The abundance of particles of a certain size helps define a soil type. Therefore, soil texture is a major characteristic used to separate soils into types or groups. The relative texture of basic soil types may be illustrated by the use of four grades of sandpaper. For example:



Sand — 3M (Sand Pak) Coarse #9003, coarse soil



Silt — 3M (Sand Pak) Fine #9001, fine soil particles



Clay — 3M (Sand Pak) Extra Fine #9000, extra fine soil particles

Loam — 3M (Sand Pak) Medium #9002, medium soil particles

COLOR



Also note soil color. Generally dark soils contain more decayed plant and animal remains than lighter soils.

MEASURING SUNLIGHT



An estimation of the proportions of shade and sunlight on the ground surface will usually be adequate. The scale given below will help students make estimates:



Very Sunny — most of the ground surface is covered by sunlight



Sunny — about $\frac{3}{4}$ of the ground surface is covered by sunlight



Moderately Sunny — equal amounts of sun and shade on the ground surface



Shady — about $\frac{3}{4}$ of the ground surface is covered by shade



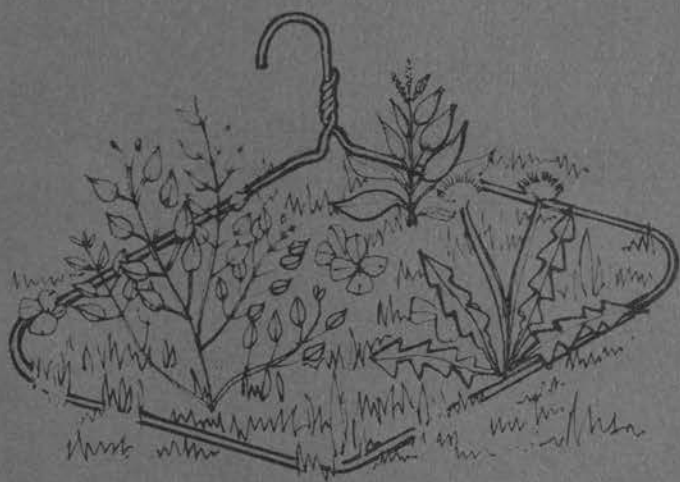
Very Shady — most of the ground surface is covered by shade

DESCRIBING THE INHABITANTS OF A PLACE

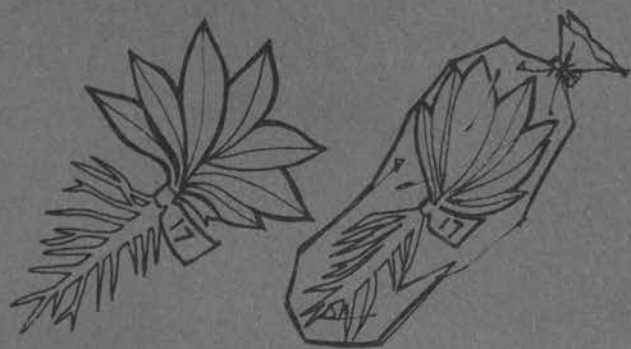


PLANTS

Ground cover plants: Use a coat hanger wire to isolate a sample plot anywhere within several feet of the station marker. Within the sample plot:

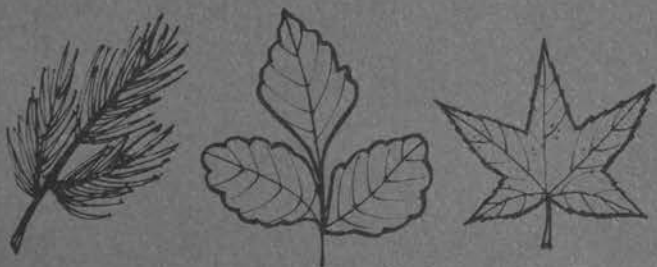


- Collect one of each different type of plant.
- Count the numbers of each type



- Wrap a piece of tape around each plant collected and put the number on the tape.
- Put the plants in a plastic bag.

SHRUBS AND TREES

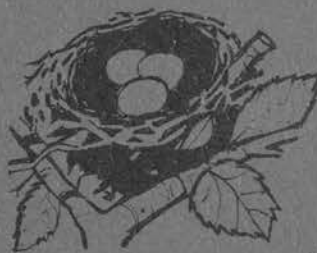


- Remove a twig with leaves from each of the most common plant types within several feet of the station marker.
- Count the numbers of each plant type and record whether they are trees or shrubs.
- Put the number on a piece of tape and wrap it around the twig.
- The twigs should be placed in a plastic bag.

ANIMALS

The presence and activity of many forms of animal life can be inferred from many signs. Encourage students to investigate slowly and critically by looking under things, among leaves and twigs and by digging under the litter on the ground surface.

Birds: Songbirds, geese, ducks, herons, hawks and more



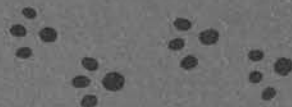
songs
egg shells
foot prints
bones
nests
feathers
half-eaten seeds
droppings



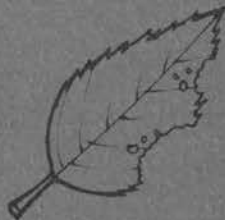
Mammals: deer, rabbits, cats, dogs, mice, muskrats, humans and more



tracks
burrows
bones
fur
muskrat houses
holes
droppings
trails and mouse runs
nut shells



Insects: bees, ants, grasshoppers, butterflies,

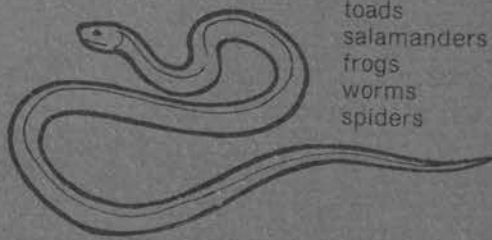


gnats
ant hills
cocoon
caterpillars
chewed leaves

Other:



snakes
toads
salamanders
frogs
worms
spiders



STEP 4 RECORDING THE INFORMATION

Decide on the kinds of information to be collected.

Make up a DATA SHEET to be used by each team of students. (Make sure there is enough space for comments and sketches.)

Being able to put together a data sheet and recording the information as it is observed are important skills for investigating the environment. Discussion and inferences taking place later on will depend on how well each team is able to complete this step.

DATA SHEET

TRANSECT STUDY

Names _____

Date _____

Station Number _____

WIND

_____	_____	_____
Ground Level	Waist Level	Above Head

TEMPERATURE

Air Temperature _____	SUNLIGHT: (Circle One) Very Sunny Sunny Moderately Sunny Shady Very Shady
Surface Temperature _____	
Soil Temperature _____	

SOIL

Moisture: (Circle One) Dry Slightly Moist Moist Very Moist Wet	TYPE: (Circle One) Sandy Silt Clay Loam
Color _____	

PLANTS: Describe or sketch your observations:

ANIMALS: Describe the animals or signs of animals you found in your area on the back side of this sheet.

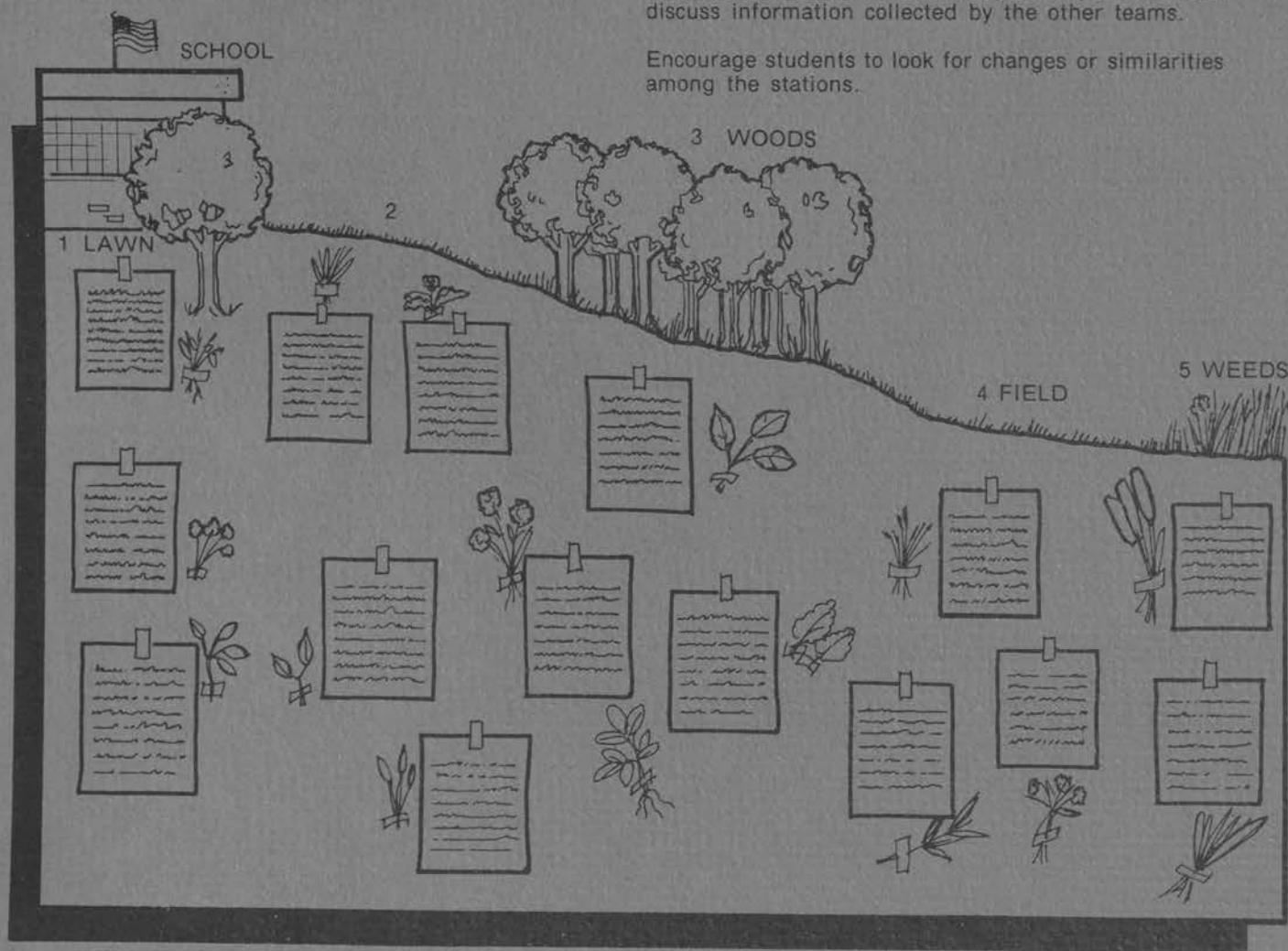
STEP 5 SHARING INFORMATION

On the blackboard or a large sheet of paper draw a picture of the study area. Show some of the topographic features and the locations of the collecting stations.

Each team should display their data sheet and plants by the station where each was collected.

Make sure students have the opportunity to read and discuss information collected by the other teams.

Encourage students to look for changes or similarities among the stations.



STEP 6 LOOKING AT THE INFORMATION

At first the students may find it difficult to think about the entire study area and the information collected at all the stations.

measurements and observations that help describe the study area.

Review the process of how the information was collected and that the display of data sheets and plants are

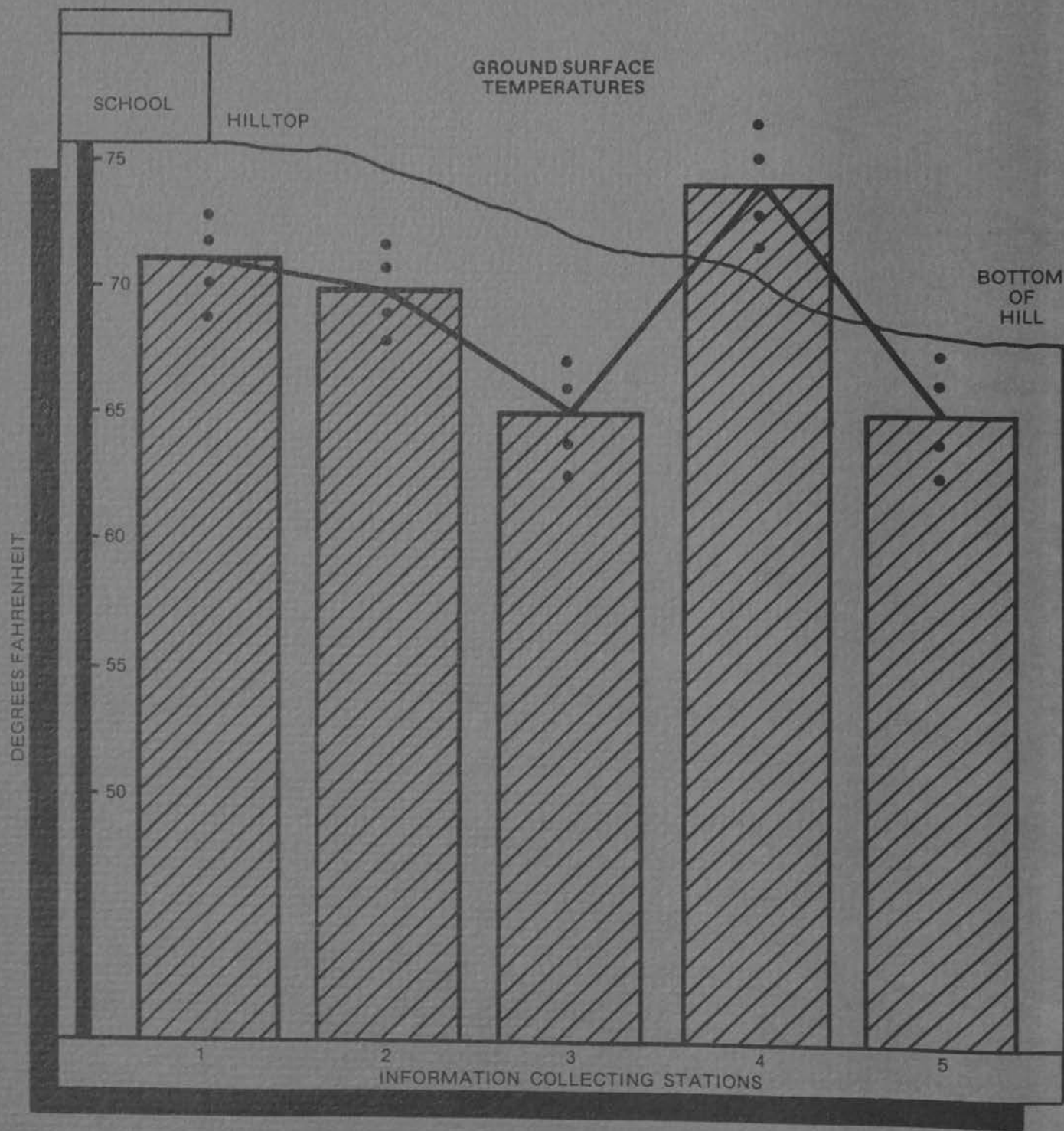
Begin by looking for differences and similarities among the collecting stations. Single out one measurement such as ground surface temperature and follow it from

station to station. Using graphs, charts or tables will help students visualize the range of temperatures.

If there is more than one temperature reading for each station, the average reading for each station should be calculated. Make sure they understand the labels for each axis. Note how the ground surface temperature

changes among the stations. Help students interpret what the graph shows.

Using charts, tables and sketches are some other ways of comparing information and may prove helpful for clarifying or uncovering relationships.



STEP 7

MAKING INFERENCES

TEMPERATURE:

1. The temperature is lowest at stations 3 and 5 because plants shade the ground.
2. The temperature is highest on the bare hillside. The soil is also very dry.
3. Why isn't the temperature as high in the grass at station 1?

Showing relationships within the information will help students ask questions about the study area. Some questions relating to the ground surface temperature graph might be:

- Why is the temperature lower among the trees at stations 3 and 5?
- Does plant cover affect the temperatures?
- Are there similar differences among the air and soil temperatures?

Questioning should be encouraged. However, students should realize that not all questions can be answered using the available information. Some questions may lead to the need to collect more information and further investigations.

In attempting to answer questions, students should be encouraged to make inferences based on the information collected. It is important to allow for individual dif-

ferences among students in how the information is interpreted. Diverse inferences should be accepted and encouraged. Inferences will change with more and better information. Answers don't have to last forever.

And above all, the investigative approach should be one of shared responsibility and enjoyment. Students should not only look to you, the teacher, for support and help but to each other. Investigation is not just finding answers, it is also the opportunity to ask questions and share ideas.

Ground surface temperature:

1. The temperature is lowest at stations 3 and 5 because the plants shade the ground.
2. The temperature is highest on the bare hillside. The soil is also very dry.
3. Why isn't the temperature as high in the grass at station 1?

PRE-TRIP PLANNING

FOR USING REFUGE AND FISH HATCHERY SITES

Planning is essential for assuring a successful trip for you and your students. Once an activity has been selected, follow these two steps to complete your plans.

• STEP ONE: MAKE ARRANGEMENTS

National Wildlife Refuges and National Fish Hatcheries are open for educational purposes at any time during the year. However, during some periods roads are

closed due to snows or high water. Please check in advance to assure availability of a site.

A phone call is sufficient to reserve a site and time. You may want to make a special appointment with the refuge or hatchery manager to review the site before arriving with your students. This would also allow you to pick up maps or equipment which could then be reviewed with students before the trip. Be sure to discuss the activity with Fish and Wildlife Service personnel in order to identify equipment or any special assistance.

• STEP TWO: MAKE A CHECKLIST

FOR THE CLASS

- ☒ BUS ARRANGEMENTS.
- ☒ CLEARANCE WITH PROPER AUTHORITIES.
- ☒ SITE RESERVED AT THE REFUGE OR HATCHERY.
- ☒ INSURANCE AND PERMISSION FORMS.
- ☒ SURVEY CLASS MEMBERS FOR EXTRA EQUIPMENT.
- ☒ LUNCHES AND DRINKS ARRANGED FOR. (School lunches cancelled).
- ☒ FIRST AID KIT. (If school bus does not have one).
- ☒ PICK UP MAP, KEY (if necessary), AND EQUIPMENT FOR THE INVESTIGATION AT REFUGE HEADQUARTERS OR HATCHERY HEADQUARTERS.

FOR EACH STUDENT

- ☒ WARM CLOTHING
- ☒ BOOTS OR OTHER WATERPROOF FOOTWEAR (In any weather).
- ☒ RAINGEAR. (If necessary).
- ☒ SUFFICIENT DATA SHEETS FOR EACH STUDENT.
- ☒ ONE PENCIL OR BALLPOINT PEN PER STUDENT.
- ☒ LIST THE EQUIPMENT FOR THE INVESTIGATION.

Also, consider the experiences of the students when selecting an activity. If it is one of the first trips, perhaps an activity near water offers too many possibilities for accidents and discomfort. A better first choice may be an upland field or forest activity.

4

SECTION

we can help



Now that you have used public lands and community resources to make student learning more real and worthwhile, we would like to offer our continued support. The U.S. Fish and Wildlife Service is already cooperating with State Departments of Education and Natural Resources, other federal agencies, and colleges to help teachers use community and public land resources.

• REGIONAL OFFICES

The Service has published other aids to environmental education. You may write to:

Region I P.O. Box 3737
Portland, OR 97208

Region II P.O. Box 1306
Albuquerque, NM 87103

Region III Federal Building
Ft. Snelling
Twin Cities, MN 55111

Region IV 17 Executive Pk. Dr. NE
Atlanta, GA 30329

Region V John W. McCormack Post
Office and Courthouse
Boston, MA 02109

Region VI P.O. Box 25486
Denver Federal Center
Denver, CO 80225

Alaska Area Office
813 D Street
Anchorage, AK 99501

• MORE ENVIRONMENTAL EDUCATION RESOURCES

These will help you with your community environmental education program:

- college credit EE methods course
- EE use of public lands for resource managers
- coordination methods for building a community EE program
- slide-tape program showing how an elementary teacher can use a wildlife refuge
- outdoor recreation facilities
- EE poster
- educational site selection